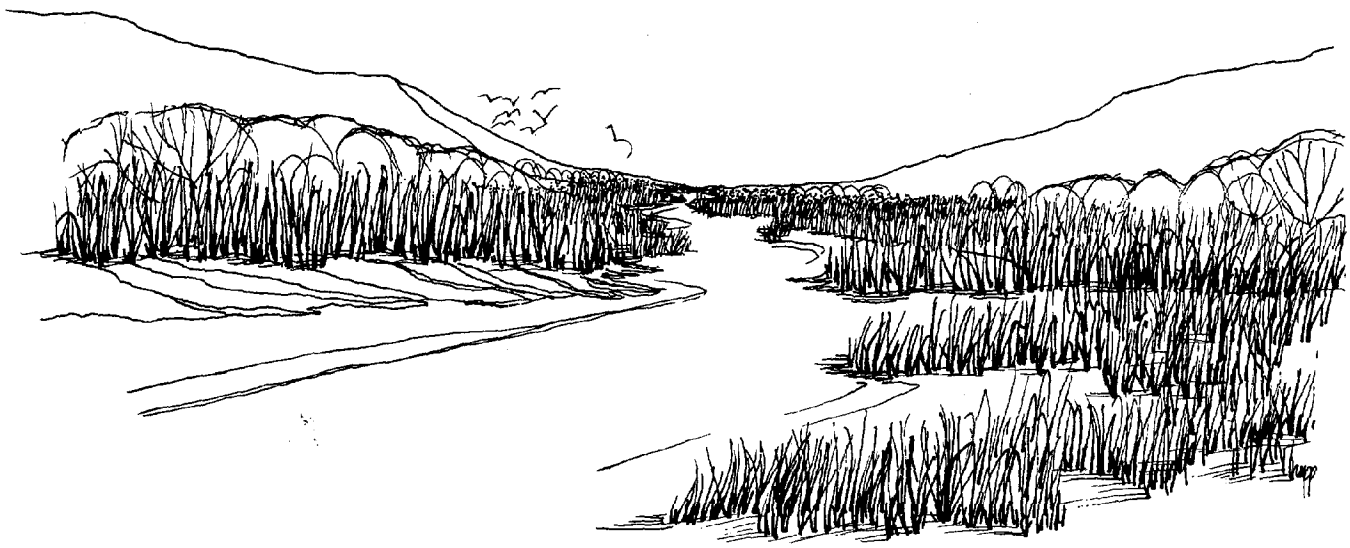

COASTAL WETLANDS OF OREGON

Oregon Coastal Conservation & Development Commission

COASTAL WETLANDS OF OREGON

22/

A Natural Resource Inventory Report
to the
OREGON COASTAL CONSERVATION & DEVELOPMENT COMMISSION
August 1973

prepared by
Glenn J. Akins. O.C.C.&D.C. Chief Planner

salt marsh mapping and description
prepared by
Carol A. Jefferson. Dept. of Botany & Plant Pathology O.S.U.

"The preparation of this report was financed in part through a comprehensive planning grant from the Department of Housing and Urban Development."

OREGON COASTAL CONSERVATION AND DEVELOPMENT COMMISSION

P.O. Box N
Florence, Oregon 97439

Phone (503) 997-8248

TO THE CHAIRMAN AND MEMBERS OF THE COMMISSION:

We are pleased to submit to you this report on the *Coastal Wetlands of Oregon*. This inventory is designed to provide a coast-wide identification of the location, extent, characteristics and management problems of our wetlands resource.

Our staff compiled the report with extensive assistance from Wildlife and Fish Commissions and individual faculty members and graduate students from the University of Oregon and Oregon State University.

The Commission should use this inventory, along with other elements of the overall planning process, to evaluate policies pertaining to the wetlands resource. The Commission also should use this information as a resource perspective during the final preparation of the coastal zone management plan.

We hope the inventory will provide the Commission with a broad understanding of our coastal wetlands resource, and that it will assist in the implementation of an effective system of management for these unique and valuable areas.

Sincerely,

James F. Ross
Executive Director

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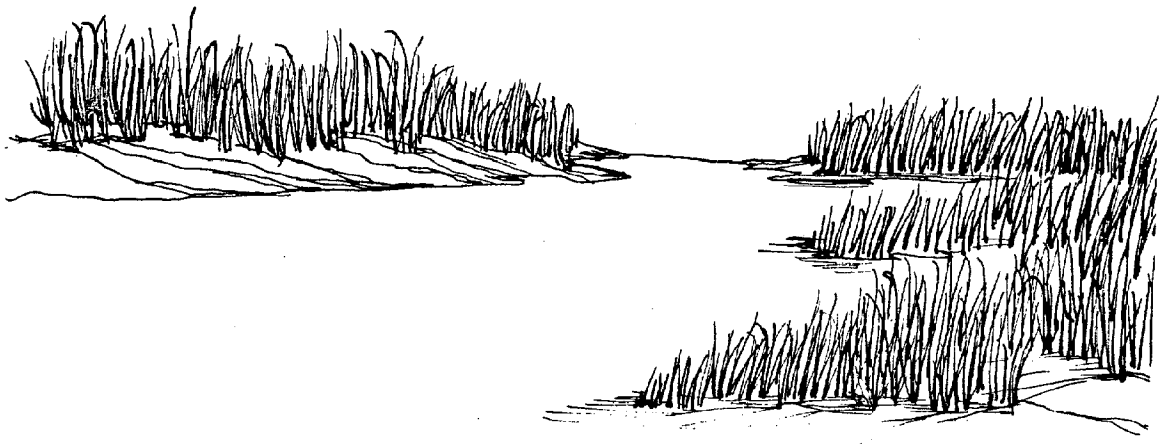
PREFACE

The coastal wetlands of Oregon are a vital natural resource. Much of our sport and commercial harvest of fish and shellfish is dependent on the food energy and shelter afforded by wetland areas such as tidal flats, salt marshes and shallow estuary waters. Additionally, the inland marshes, swamps and bogs of the coastal zone produce many species of fish and wildlife and lessen the damage of flood and drought periods through the storage of ground and surface waters. Wetlands are also among the most scenic landscapes characteristic of the coastal zone.

This report identifies and describes the coastal wetlands of Oregon and outlines the management problems and opportunities these areas represent. The report has been compiled to support the development of a coastal zone management program by the Oregon Coastal Conservation and Development Commission.

As is the case with all OCC&DC inventories issued prior to the Fall of 1974, this publication is in draft form. The reader is urged to forward any corrections, additions, or comments he may have regarding this report to the OCC&DC staff.



INTRODUCTION. . .

WHAT ARE WETLANDS

Wetlands may be defined as those "areas on which standing water, seasonal or permanent, has a depth of six feet or less and where the wet soil retains sufficient moisture to support aquatic or semi-aquatic plant life" (Metzgar, 1968).

In the Oregon coastal zone, this definition includes a variety of natural communities from the seaward edge of the estuaries inland to the flooded upland valleys of the coast range. Individual wetland types which occur in the coastal zone include:

Estuary Wetlands	(1)	shallow estuarine waters;
	(2)	eelgrass beds;
	(3)	tidelands;
	(4)	coastal tidal marshes;
Inland Wetlands of the Coastal Zone	(5)	inland fresh marshes;
	(6)	bogs and swamps;
	(7)	lakes and reservoirs;
	(8)	riparian vegetation; and
	(9)	inter-dune wetlands, or "dunes marshes".

Definitions of each specific wetland type are included in the DESCRIPTION section of this report.

Although estuary wetlands, particularly tidal marshes, are more widespread and significant on a state-wide basis (and therefore emphasized in this report), the importance of the less-familiar types also is discussed.

McCaffery Slough - Yaquina Bay

OCC&DC CONCERN FOR COASTAL WETLANDS

The Oregon Coastal Conservation and Development Commission (OCC&DC) was established by the State Legislature in 1971 to develop a resource management program for the coastal zone. To complete this charge, the Commission is conducting three major work efforts:

(1) a *policy development process*, to identify management policies and guidelines through extensive involvement with citizens of the coastal zone and the state, and representatives of a variety of groups and agencies concerned with coastal resources;

(2) an *inventory process*, to identify the natural characteristics and appropriate uses of coastal resources; and

(3) an *implementation process*, to develop recommendations for carrying out resource management policies approved by OCC&DC and adopted by the Legislature.

The inventory task is being completed by OCC&DC staff, the Commission's Advisory Committee, and a number of agencies and individuals associated with OCC&DC. The implementation process is the "action" phase of the policy development task and as such is a responsibility of the OCC&DC itself.

OCC&DC's concern specifically for wetlands originated in July, 1972, when the Commission identified 18 "Critical Resources" to be included in the coastal zone management program. Wetlands were identified as a high priority concern.

The Commission further expressed concern on April 13, 1973, by voting to "recommend to all state natural resource agencies, county and city governments, and port commissions to protect all salt marsh areas against irreversible acts until the OCC&DC approves development standards for these areas."

The policies development process for wetland areas has been underway since March 30, 1973. At that time participants at the OCC&DC workshop in Florence suggested a number of management policies for consideration by the Commission. On July 13, 1973, the first of a series of workshops involving resource management specialists was held to integrate technical viewpoints into the policy development process.

OCC&DC directed staff to gather inventory information on coastal wetlands in December of 1972. This report is a first response to tnat charge.

PURPOSE AND SCOPE

The purpose of this report is to support the development of policies for the management of coastal wetlands by OCC&DC. To achieve this objective, the report contains an identification and description of wetlands in terms of:

(1) location and extent;

(2) important physical and biological characteristics;

(3) management problems and opportunities; and

(4) criteria for developing a priority of uses.

The report contains two sections. The MANAGEMENT section relates directly to OCC&DC's legislative charge to recommend appropriate uses for natural resources. The DESCRIPTION section provides background information on the wetlands resource which the Commission may use to explain *why* specific resource policies were chosen and *why* they should be adopted by the Legislature.

The function of OCC&DC is to provide a regional* and coast-wide approach to resource management, meaning that the overall interests of the people of Oregon, especially the residents of the coastal zone, must be considered in establishing resource use guidelines to be applied in each local area. A resource management program approved by OCC&DC and adopted by the Legislature will be state policy for the coastal zone. Detailed resource development plans of coastal counties, cities and ports, and the decision process of individual state natural resource agencies will be required to conform to this program. For this reason inventory activities described herein are *regional* rather than local in scope, and are designed to provide a coast-wide understanding of the wetlands resource. Information on property lines, tax assessments and individual development proposals are not identified for specific locations. Such tasks are a *local* planning function and are to be completed by groups involved in estuary, county and community plan development. In some cases, however, information contained in this report may be directly applicable to a local planning situation.

METHOD OF STUDY

As shown on the accompanying diagram, this report consists of a description of existing wetland areas and an

*Regional planning is planning at an intermediate level, between the national level and the local level (McLoughlin, 1969).

assessment of the management implications of various uses on those areas.

Descriptions of the wetland types (except tidal marshes), identification of resource values, uses and impacts, and development of the management section of this report have been completed by Glenn J. Akins, OCC&DC Chief Planner. This effort entailed field work, library research, and contact with others involved in wetlands management in Oregon and in other states.

Existing maps and aerial photographs were used to identify the extent and general location of wetland areas in the coastal zone. This initial survey was compared against maps developed by the Oregon Wildlife Commission to identify vegetation habitat types of value to wildlife. In the case of significant differences between the two sources of information, field interviews were conducted with district biologists to resolve the issue.

Tidal marshes have been mapped and described by Carol A. Jefferson of the Department of Botany and Plant Pathology at Oregon State University. Eight distinct vegetation types within individual salt marshes have been delineated using tidelands maps produced for Oregon estuaries by the Division of State Lands at a scale of 1" = 1,000' (except for the Coos Bay map, which is at a scale of 1" = 1,500'). Marsh vegetation maps were produced in the field and are based on three years of research in Oregon salt marshes by Ms. Jefferson. After the maps were completed, a flight was made over several estuaries resulting in some minor corrections to the original maps.

A recommendations chapter has been developed as a part of this report. Because these recommendations must be integrated into the OCC&DC policy development process, and because they must be evaluated against recommendations for other coastal resources, they are not included herein for public distribution. These recommendations are currently being referred to OCC&DC for review and comment. A completed recommendations chapter will be a part of the final wetlands report, which will be printed for general circulation in the Fall of 1974. Preliminary drafts of the recommendations are available from OCC&DC staff.

The approach used in developing this report has been determined by the resource planning process of OCC&DC, which requires that each resource category (including wetlands) be investigated in terms of (1) the characteristics and capacities of the resource itself; and (2) demands on the resource (and the resource area) from existing and potential users. The latter task requires an understanding of the local and

regional economy, development patterns, trends of ownership and taxation, accessibility, health hazards, and many other factors which influence planning for the use of land and other resources. Although these factors will be considered to some extent by OCC&DC prior to recommending completed resource use guidelines to the Legislature, they are not discussed in this report.

The approach used herein is that of investigating wetlands as a natural community within which there are significant interacting physical and biological factors, all of which must be considered in a management program. This approach further recognizes that resource uses may occur in a manner that either sustains, impairs or destroys these inherent functions and values.

There are some basic problems in using this approach, in that:

(1) at least one research (Eltringham, 1972) has questioned whether coastal wetlands are sufficiently distinguished from both the shore and marine/estuarine environments to be considered a separate natural community; and

(2) the major modifications of wetland areas in the Oregon coastal zone have come about not because of the inherent characteristics of these resources, but because of location, the fact that wetlands are a shoreland resource.

However, it is becoming increasingly recognized that wetland areas are of substantial importance to man, and that the inherent functions and values of these areas should be used as criteria for management.

It is also recognized that the constraints of time, funds, and staff experience preclude the detailed consideration in this report of all factors relevant to coastal wetlands management. Since this effort is a "first step" in a coast-wide resource inventory, the focus is on the inherent functions and values, the characteristics which make wetland areas special and significant to man.

Other materials regarding wetlands which have been developed by OCC&DC include:

(1) wetlands inventory sheets, on which is recorded basic resource, land ownership and use, and other information,

with numerical codes which will facilitate storage within an information system;

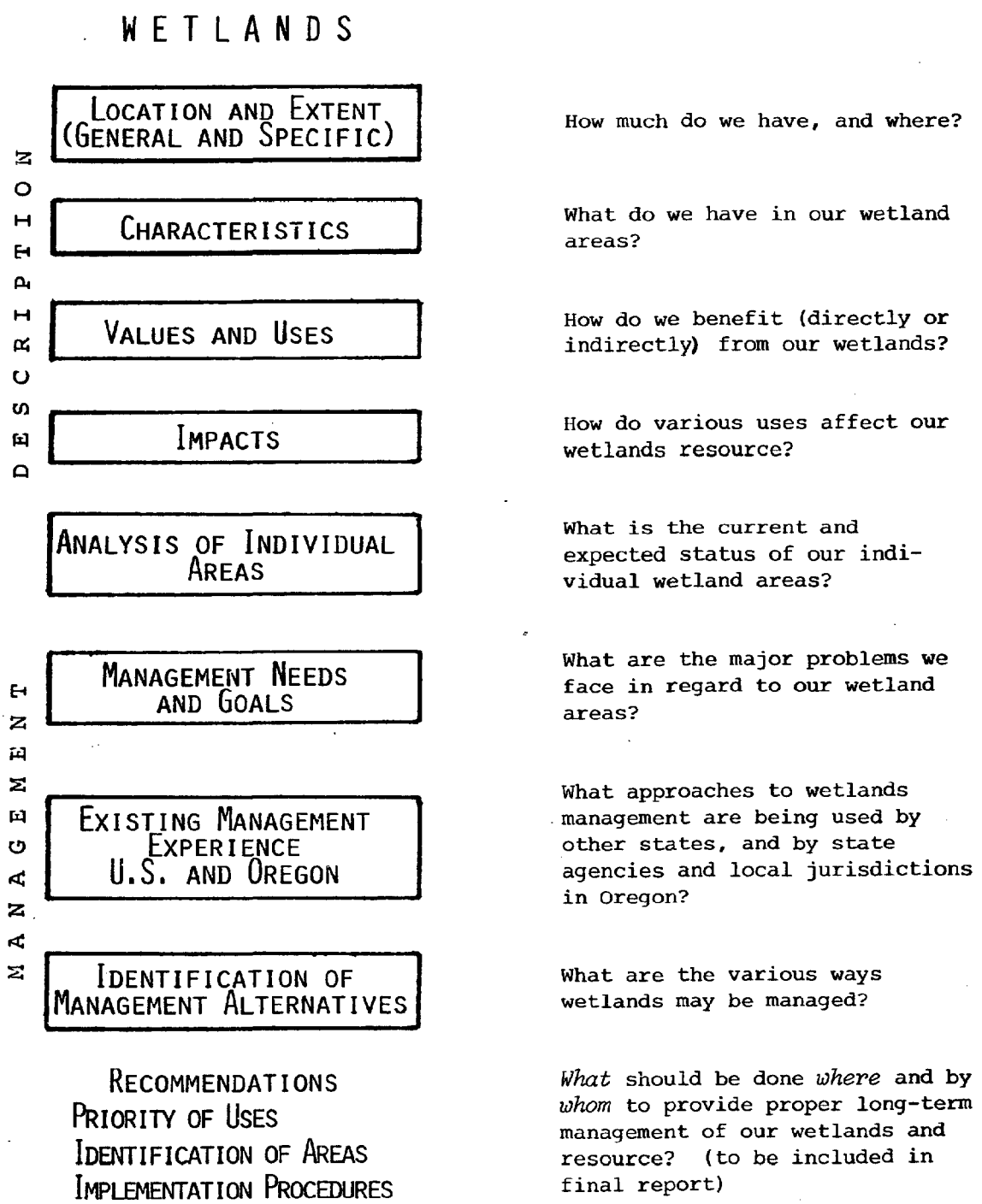
(2) coast-wide resource inventory maps, which indicate the location and extent of coastal wetlands in relation to the local and regional environment.

(3) large-scale (1" = 1,000') estuary maps which indicate the location and extent of the eight tidal marsh types described in this report; and

(4) a slide program illustrating wetland types, issues and concerns in the Oregon coastal zone.

METHOD OF STUDY

Identification of Wetlands as Resource of Critical Environmental Concern by OCC&DC



PREVIOUS WORK

The following works (used in developing this report) have been completed on a regional or coast-wide basis:

(1) the Oregon *Statewide Fish and Wildlife Plan,* which is being completed by the State Wildlife Commission, indicates conditions affecting fish and wildlife resources through 1980, and contains acreage estimates for eight wetland and wetland-related habitat vegetation types (compiled for the game management districts in the coastal zone);

(2) the *Inventory of Filled Lands* for Oregon estuaries which was completed in 1972 by the Division of State Lands, identifies the extent of estuaries and their watersheds, acreages of tidelands, and the location, extent and ownership of fills placed in the estuaries;

(3) Carl L. Johannessen's "Shoreline and Vegetation Changes of the Estuaries", pp. 100-151, in Samuel N. Dicken's *Some Recent Physical Changes of the Oregon Coast,* which created much interest in the coastal wetlands of Oregon, compares vegetational change and the historical location of tide marsh margins in the Coquille, Coos Bay, Umpqua, Alsea, Tillamook, and Nehalem estuaries, and described the advance of marsh into the estuaries;

(4) Carol Jefferson's *Some Aspects of Plant Succession in Oregon Estuarine Salt Marshes* (unpublished, Oregon State University Botany Department), describes the pattern of marsh plant succession on a coast-wide basis;

(5) *Crisis in Oregon Estuaries,* compiled in 1970 by the Oregon Chapter of the American Fisheries Society (edited by William Q. Wick) directs attention to threats to estuary resources, and indicates management approaches which may be integrated into subsequent planning efforts;

(6) the *Wetlands Inventory: Oregon* (1954) of the U.S. Department of the Interior, Fish

and Wildlife Service, includes an estimate of wetland types and acreages for approximately one-third of the coastal zone in 1954; and

(7) *Descriptions and Information Sources for Oregon's Estuaries*, a 1973 report of the Water Resources Research Institute of Oregon State University, which provides a data survey of physical and biological characteristics of Oregon's estuary areas.

Studies of individual wetland areas (generally estuaries) which have been used in this report include:

(1) an (unpublished) inventory of the Coos Bay Estuary, completed by students and faculty of the Oregon Institute of Marine Biology at Charleston under the direction of Dr. Paul Rudy in 1972;

(2) *An Interdisciplinary Study of the Coos Bay Estuary*, completed by Student-Originated Studies Program participants at the Oregon Institute of Marine Biology in 1971;

(3) *Natural Resources, Ecological Aspects, Uses and Guidelines for the Management of Coos Bay, Oregon*, completed by the U.S. Department of the Interior in 1971;

(4) *Fish and Wildlife of Yaquina Bay, Oregon*, a study conducted by the U.S. Fish and Wildlife Service in 1968; and

(5) *The Oregon Dunes NRA Resource Inventory*, completed by the staff of the Siuslaw National Forest in 1972.

FUTURE WORK

There is a need for additional information to enable proper management of wetland areas. Some of this information may be developed by OCC&DC prior to 1975. However, much additional research by state agencies, universities, and

individuals is necessary or desirable to provide information specific to coastal Oregon regarding:

(1) levels and types of production and nutrient cycling by different wetland communities;

(2) the location of bogs and swamps of scientific importance;

(3) wetland areas which provide habitat to rare, unique and endangered species;

(4) the original pre-European settlement extent of coastal wetlands;

(5) the potential for marsh expansion in Oregon estuaries at current and projected rates of sedimentation;

(6) the value of reclaiming wetlands which have been diked or drained; and

(7) techniques of establishing wetland areas through deposition of dredge spoils.

ACKNOWLEDGEMENTS

Although this report was compiled by OCC&DC staff, most of the information contained herein has been derived from the experience of others. These include coastal residents and officials concerned about our wetland areas; biologists, engineers and planners responsible for management of these areas; and, students and faculty of local colleges and universities who have invested much time and energy in the study of coastal resources. OCC&DC wishes to acknowledge the generous provision of assistance, information and materials for the completion of this report from the following agencies and individuals:

Oregon Wildlife Commission

Wesley Batterson, District Wildlife Biologist, Nehalem
David Heckeroth, District Fisheries Biologist, Tillamook
James Hutchinson, District Fisheries Biologist, Florence

Warren Knispel, District Fisheries Biologist, Gearhart
Robert E. Maben, Wildlife Biologist, Portland
Rolland F. Rousseau, Assistant Chief of Environmental Services, Portland
Robert Saltzman, District Supervisor, Corvallis

Oregon Fish Commission

Brent Forsberg, Fisheries Biologist. Newport (OCC&DC Advisory Committee Member)

Division of State Lands

Mark E. Harbert, Engineering Technician, Salem

Oregon Department of Transportation

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Executive Department, Local Government Relations

Alan Hedberg, Program Manager, Salem

University of Oregon

Dr. Jerome Diethelm, Head, Department of Landscape Architecture, Eugene
Dr. Carl E. Johannessen, Professor of Geography, Eugene
Dr. Paul Rudy, Director, Institute of Marine Biology, Charleston

U.S. Fish and Wildlife Service

John E. Chattin, Chief of Flyway Management, Portland

U.S. Army, Corps of Engineers

Robert J. Moulton, Environmental Planner, Portland

U.S. Department of Agriculture, Soil Conservation Service

Herbert Carnahan, Staff Leader, Salem
Frank Reckendorf, Soils Scientist, Salem

Oregon District 4 Council of Governments

Marvin E. Gloege, Executive Director, Corvallis

Clatsop County

Terry Marden, Planner, Astoria

Tillamook County

Jack Lesch, Director of Planning,
Tillamook

Lincoln County

Paul Brookhyser, Planner, Newport
Phil Smith, County Assessor's Office,
Newport (OCC&DC Commissioner)
Lynn Steiger, Director of Planning,
Newport

City of Coos Bay

George Lavios, Director of Planning,
Coos Bay

OCC&DC Staff Participation

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DESCRIPTION. . .

WETLANDS IN THE COASTAL ENVIRONMENT

Wetlands are rarely permanent features of the landscape, even in man's limited time perspective. These areas represent a particular stage in the geologic history of a region. In effect, they are resources in transition from one form to another. As the physical environment changes, wetland areas may rapidly change in extent, either growing to cover thousands or millions of acres, or drying and disappearing in a few seasons.

The great wetland areas of North America, the potholes and marshes of the midwest, and the coastal marshes and swamps of the Atlantic and Gulf Coasts, are a result of post-glacial climatic conditions. Approximately 20,000 years ago, the last great advance of glacial ice spread across the Continent, and resulted in a major lowering of the sea level, from 300 to 450 feet below the present level. As the glaciers melted, the sea level increased once again, until maximum submergence was reached about 6,000 years ago. After the glaciers had retreated northward and the waters of the sea and the rivers rose to fill the scoured lakebeds and river channels, vast marsh and swamp areas began to form wherever the land and water met. As the post-glacial climate warms, these wetland areas gradually dry and become covered with upland vegetation. But on the coasts, the tempering influence of the sea slows this process, and storm tides continue to flood the lowlands, increasing the persistence of wetland vegetation through time.

Geologic processes are also significant in forming the features of the coastal environment. The East Coast of North America is slowly submerging. As the great offshore barrier islands erode during winter storms, the waters of the sea continue to surge up the coastal rivers, sustaining the vast areas of wetlands characteristic of our Atlantic states. The Pacific Coast, however, is emerging, and as the steep slopes erode during the constant and heavy rains of winter, sediment is deposited intensively in the river mouths, now flooded by the high post-glacial sea level, gradually decreasing the area of free contact with the sea. Thus, the great wetland expanses of the Atlantic and Gulf Coasts are sustained by limitless contact and exposure to the sea. The existence of the Pacific Coast wetlands, on the other hand, depends on a few, narrow openings to the sea along the steep and rugged

coastline. Only on the margins of the "inland sea" of San Francisco Bay have extensive wetland areas developed.

Sand Lake Estuary

Much of the existing information on wetlands management is derived from the experience of Atlantic coastal states. In evaluating this experience, it may be appropriate to consider that the Pacific wetland areas are generally more limited in extent, geographically isolated, and vulnerable to changes in the physical environment.

There are approximately nine different types of wetlands, differentiated on the basis of vegetation, which will be discussed in this report. These types, however, may be included within two general categories based on the environment in which they occur. These two categories are:

(1) *Estuary Wetlands*, those marshes, tideflats and shallow waters occurring in close proximity to the sea and

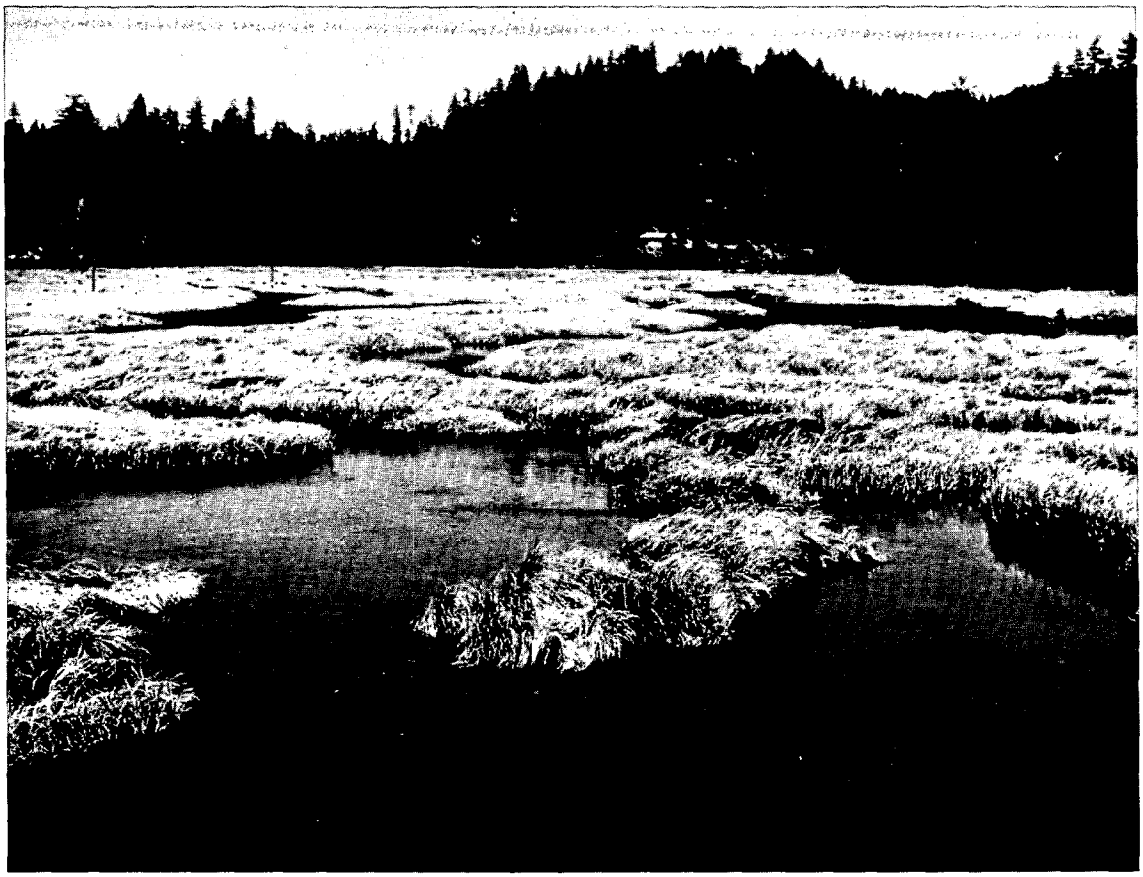
primarily (although not exclusively) tidal and salt water in character; and

(2) *Inland Wetlands*, those fresh water marshes, swamps and bogs of the coastal zone which occur inland from tidal influence and the major sand dune sheets.

Estuary Wetlands

FORMATION OF ESTUARY WETLANDS

Oregon's estuaries, the tidal mouths of the coastal rivers, have resulted from a rising sea level and the



Marsh Area of Boone's Slough, Yaquina Bay

consequent filling of the lower portions of the coastal valleys by sediments. Extensive deposits of clay and silt are transported into the estuary and mixed with sand. The daily action of tides and seasonal changes in river flow constantly rework these materials. Along the margins of the estuary where these sediments are deposited, wetland vegetation may become established.

Extensive sedimentation has occurred in the Coquille, Coos, Umpqua, Siuslaw, Yaquina, Netarts, Tillamook and Nehalem estuaries, with lesser amounts in the Alsea, Siletz, Salmon, Nestucca, Sand Lake and Necanicum estuaries (Dicken, 1950). Very limited estuary deposits (and therefore practically no salt marshes) occur in the Rogue and Chetco estuaries. Gravel, sand and silt carried in suspension (or as bed load) in the coastal streams is deposited wherever the velocity of the stream decreases. The clay particles among the sediments are carried further seaward, finally being deposited when water movement stops and mixture with salt occurs at slack tide. The presence of vegetation on the margins of the estuary substantially increases this deposition of clay (Johannessen, 1961). The area where this material may be deposited is enlarged by the action of the tide damming the coastal streams, which overflow their banks and spread across the adjacent lowlands. The area in the estuary where this flooding takes place is described by Wolf Bauer as the "surgeplain". This area is essentially the extension of the floodplain in the delta area of the estuary. Bauer points out that this "fringe environment" may be wetted as infrequently as once a month, or as frequently as twice a day, and contains marshes, bogs, wet meadows and swamps.

The formation of wetland begins with the deposition of material along the margins of the estuary, forming shallows. These shallow water areas are basic wetland types in themselves, with independent functions and values, as well as being essential components of the other wetland types. When deposits build up above the low tide level, the tideflat wetland type is established. When the tideflat becomes sufficiently stabilized for rooted vegetation to become established, the tidal marsh wetland type is formed. The marsh itself is a dynamic community within which an orderly replacement of plants takes place through time, and eventually, the process would produce an upland meadow or Sitka spruce woodland. In Oregon the older high marshes are diked, drained or otherwise modified by man before this transition to an upland community takes place.

EXPANSION OF ESTUARY WETLANDS

Policies for resource management must take into account the wetland-forming process of sedimentation, the changes which take place on the tideflats, and the dynamic nature of the marsh, in order to foresee and deal with possible future conditions in the estuaries. Basically, tideflats increase in elevation through continued deposition from coastal rivers and often through the action of invertebrates which bore in the mud and pump partially digested particles upward in small mounds. After the mudflats become colonized by pioneer plants* the vegetation entraps increasing amounts of mud. The flat then increases with the sediment of each tide flowing over it. This process has been compared to the building of dunes planted with marram grass, where the sand is caught by the plants as both rise in height (Eltringham, 1971).

Kilchis River Delta in Tillamook Bay

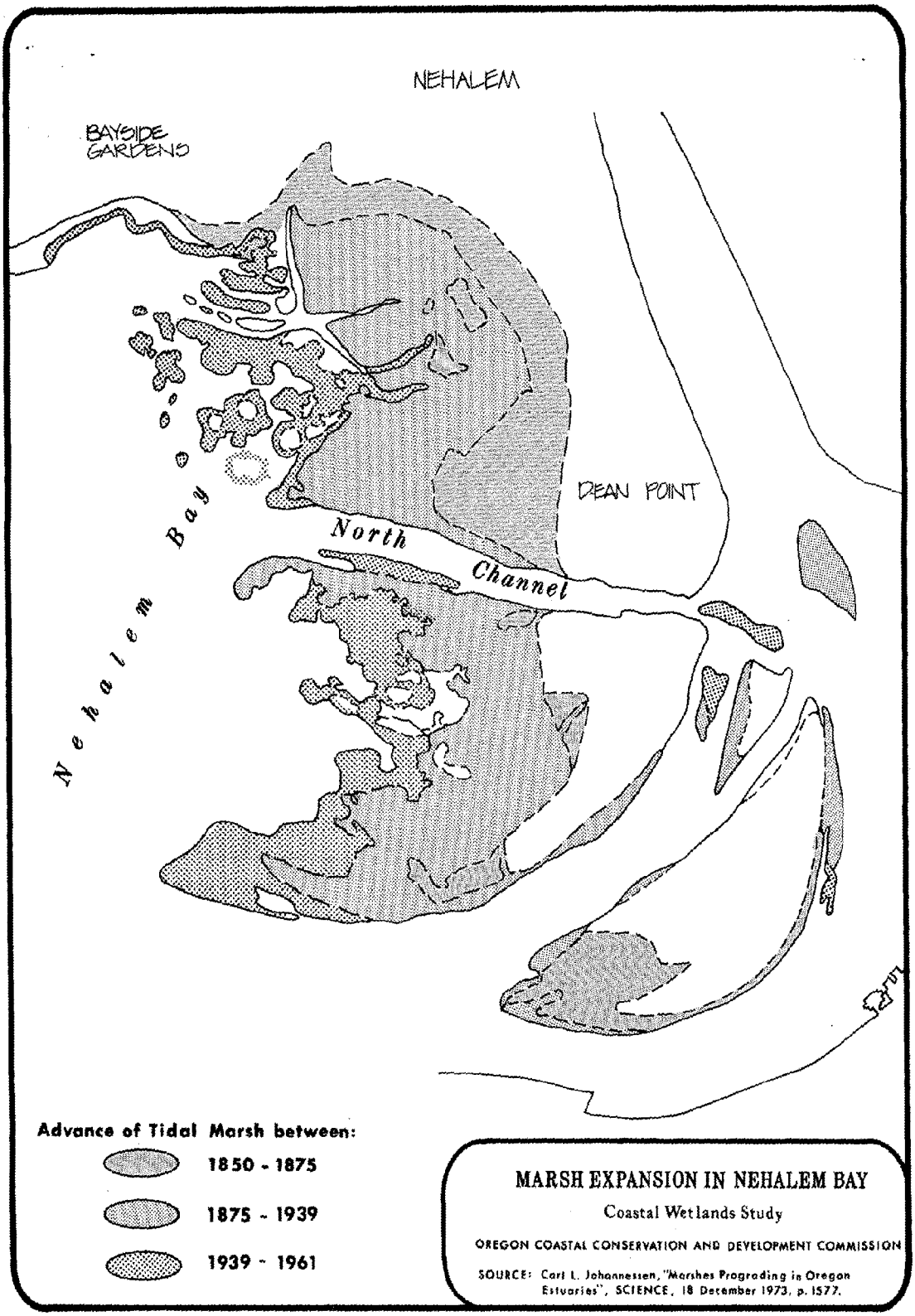
*Pioneer organisms are species able to tolerate extremely unfavorable conditions and therefore are the first to colonize new environments (Knight, 1965).

As this elevation process continues, the interior of the marsh community is less frequently covered with salt water, allowing plants not tolerant to high salinity levels to become established. Thus a successful pioneer species may enable the entire marsh community to develop rapidly in its wake as it expands outward on the mudflats.

Little is known about the extent of estuary wetlands prior to the settlement of the Oregon coast by Europeans. The consequences of settlement and land use on the formation of wetlands in Oregon estuaries has been studied by Carl L. Johannessen of the University of Oregon. Johannessen concludes that relatively little expansion of marsh occurred in Oregon estuaries before 1850. Except for the broad marine terrace areas, we can assume that these wetlands were primarily small tideflats and "fringe marshes", located on the extreme edges of the estuaries (similar to the present day marshes of South Slough, Coos Bay or Netarts Bay), where protection was afforded from the tidal scour characteristic of the channel areas. Over the past 150 years, logging and burning in the Coast Range (and some activities within the estuary) have greatly accelerated the natural filling process. The expansion of marsh into the estuary may take place as a result of a slight increase in the elevation of the mudflats. Thus, the extensive man-caused sedimentation of the past century provided an environment for the rapid expansion of tidal marsh. As stated by Johannessen (1961), "It is definitely established that the (marsh) vegetation, once started, can greatly accelerate the accretion process and induce changes in the shoreline."* As shown on the map of Nehalem Bay, this process of change is extensive in some areas. It has been occurring since man first disturbed the coastal watersheds, and it continues today.

Thus, the three major wetland types of the estuary environment (shallow estuary waters, tideflats, and tidal marshes) are closely interrelated, and are indeed only different stages of the same process, the filling of a sea-drowned river valley.

*The shoreline is defined by Johannessen as the margin of the land that has dense enough vascular vegetation to be seen in aerial photographs.


NEHALEM
BAYSIDE GARDENS
DEAN POINT
North Channel
Nehalem Bay
Advance of Tidal Marsh between:
1850 - 1875
1875 - 1939
1939 - 1961
MARSH EXPANSION IN NEHALEM BAY
Coastal Wetlands Study
OREGON COASTAL CONSERVATION AND DEVELOPMENT COMMISSION
SOURCE: Carl L. Johannessen, "Marshes Prograding in Oregon Estuaries", SCIENCE, 18 December 1973, p. 1577.

TYPES OF ESTUARY WETLANDS

Individual wetland types are defined and described in terms of their plant and animal communities, and an identification is made of the location and extent of each in the coastal zone. This information will provide a perspective for evaluating these areas in terms of existing and prospective uses. Acreages for each wetland type have been provided to OCC&DC by the Oregon Wildlife Commission. The information retrieval from the *Statewide Fish and Wildlife Plan* is included as an appendix to this report.

Estuary and Bay Wetland Type

Definition: The estuary and bay wetlands may be defined as those water areas shallow enough to be diked and filled (Shaw and Fredine, 1956). An arbitrary definition of standing water six feet in depth or less is often used if a measurable standard is required. The Eelgrass, Tidelands, and Coastal Salt Marsh wetland types are included within the Estuary and Bay acreages listed in the *Statewide Fish and Wildlife Plan*.

Physical Characteristics: Current and salinity, the primary factors affecting the estuary system, vary considerably from one area to another. Considerable seasonal differences occur in the stream flow entering estuaries from the Coast Range. Large volumes of fresh water flood the estuary in winter reducing salinity, while in summer these flows drop significantly. Tides and winds push wedges of salt water through the estuary and up the river, producing considerable daily fluctuations. Other physical factors of importance include the density of water masses, the shape of the estuary basin, air temperature, and exposure to sunlight.

Biological Characteristics: The survival of the plants and animals of the open estuary waters depends on adjustment to changing levels of salinity, and on ability to withstand tides and currents. For this reason, most estuary organisms are (benthic) buried in the bottom mud or attached in some way. Bottom species include a variety of worms and other invertebrates (including crabs and shrimp), and a variety of fish. Bottom species in estuaries are considered to be more abundant and valuable than those found either in the ocean or in fresh water (Cronin and Mansueti, 1971). There is a great variety of small to microscopic plants (phytoplankton) and animals (zooplankton) floating in the water (and thereby drifting with the tides and currents). The distribution of this plankton in the estuary is determined by physical factors, especially salinity. Phytoplankton is often

concentrated at the surface and in the fresher parts of the estuary. In terms of more complex life forms, the estuary contains many species of fish and serves as a feeding ground for numerous waterfowl and wading birds. Oregon's estuaries are used extensively for wintering and resting by the migratory birds of the coastal portion of the Pacific Flyway.

Location and Extent: There are 17 major estuaries located along the Oregon Coast with a total acreage of approximately 132,500 acres, including the 90,000 acreas of the Columbia River estuary (in Washington and Oregon). The estuary and bay habitat type, as estimated by the Oregon Wildlife Commission includes 81,248 acres of this total. Half of the estuary and bay wetland type is located in Clatsop and Tillamook Counties, a quarter in coastal Douglas County, and the remainder in Lincoln, western Lane, and Coos County. Curry County contains only 440 acres, or less than 1% of the estuary and bay wetland type.

Distribution of the Estuary and Bay Wetland Type

County	Acreage	% of Total
Clatsop	23,581	29.0
Tillamook	15,868	19.5
Lincoln	7,890	9.7
*Lane	8,915	11.0
*Douglas	17,754	21.9
Coos	6,800	8.4
Curry	400	0.5
	81,248	100.0

*Coastal Portion

Coastal Tidelands Wetland Type

Definition: The land between the mean high water line and the mean low water line; the area covered and uncovered by the daily rise and fall of the tide.

Physical Characteristics: Tideflats consist of sediments, primarily gravel, sand, silt and clay, washed into the estuary by the coastal rivers and the sea. Mud flats composed primarily of clay become compacted and less suitable than mixed sediment flats for biological activity. The tideflats also contain a large amount of organic material, primarily deteriorated particles of marsh plants and other plant refuse from upland areas. Because of this organic load and the action of bacteria in the mud, oxygen is depleted in the tideflats at rates which vary with the mixture of sediments. Tightly packed particles of clay allow for little penetration

of gases, and therefore mud flats may become deficient of oxygen. Adequate circulation in the estuaries provides for a more desirable combination of sediments.

Mud flats, especially those with a low sand percentage, are often *thixotropic*, or unstable when agitated. Marsh vegetation consolidates this material and stabilizes it somewhat, but construction on tideflat and marsh fills are often susceptible to the consequences of thixotropic instability in times of earth movement (such as slides or tremors).

Biological Characteristics: Significant organisms in the tideflat zone include eelgrass and other species of algae which live in the water or on the thin film of water held by the capillary attraction of the tideflat particles. The tideflats support an animal community primarily of burrowing organisms, the most familiar being various species of clams. Physical factors such as currents, salinity, water quality, and temperature have a significant influence on tideflat organisms. These are creatures of the estuary as a whole, not just of the immediate tideflat environment. As a result, tideflats generally support a relatively few species of which there are a great number of individual organisms (Eltringham, 1971). However, when eelgrass becomes established on the tideflats a much more favorable environment is created for a number of organisms.

Location and Extent: Tidelands occur in all of Oregon's 17 estuaries, although this wetland type is limited in many locations, such as the Chetco estuary which contains 12 acres of tidelands. There are 44,600 acres of tidelands in the coastal zone (including 25,000 acres in the Columbia River estuary). Of this total, the Oregon Wildlife Commission estimates 25,000 acres are important as habitat.

Distribution of the Coastal Tidelands Wetland Type

County	Acreage	% of Total
Clatsop	6,286	24.9
Tillamook	6,791	26.9
Lincoln	3,286	13.1
*Lane	673	2.6
*Douglas	3,340	13.3
Coos	4,720	18.7
Curry	100	.4
	25,196	100.0

*Coastal Portion

Eelgrass Wetland Type

Definition: The eelgrass wetland type is composed of those beds of eelgrass *(Zostera maritima)* which occur in Oregon estuaries.

Physical Characteristics: Eelgrass occurs in the well-flushed high salinity areas of the estuary where the bottom is not affected by intense sedimentation or other natural or man-caused disturbances. The density of the beds changes seasonably as well as from one year to another (U.S. Department of the Interior, 1971). Eelgrass is tolerant to long-term submergence and is the dominant plant on the lower tidelands. Inorganic and organic material collects in eelgrass and adds to the buildup of tideflats. Thus eelgrass, in many cases, represents the first stage in the transition of a tideflat to a mature marsh community.

Biological Characteristics: Eelgrass provides an environment for a great variety of organisms on the mud below, within the plant mass, and in the surrounding waters. The most familiar animals of the eelgrass community are the Dungeness crab and several species of clams. These communities are especially significant to the use of the estuary by migratory birds and fishes.

Location and Extent: Eelgrass occurs on the tideflats of most of the Oregon estuaries. Smaller estuaries with limited tidelands and intensive fresh water flows have little or no eelgrass. The Oregon Wildlife Commission estimates there are approximately 5,000 acres of eelgrass in the Oregon coastal zone, with approximately 80% of this amount occurring in the estuaries of Coos and Tillamook Counties.

Distribution of the Eelgrass Wetland Type

County	Acreage	% of Total
Clatsop	80	1.6
Tillamook	2,400	47.8
Lincoln	436	8.7
*Lane	323	6.4
*Douglas	100	2.0
Coos	1,680	33.5
	5,019	100.0

*Coastal Portion

WETLAND LANDSCAPES

Tidal Marsh Wetland Type

Definition: The tidal marsh wetland type is composed of those communities of vascular aquatic and semi-aquatic vegetation rooted in poorly-drained, poorly aerated soil, which may contain varying concentrations of salt, occurring from lower high water (LHW) inland to the line of non-aquatic vegetation.

This type may be further defined as those estuary lands where the indigenous vegetation consists of:

(1) seaside arrow grass *(Triglochin maritima)*
(2) Pacific silverweed *(Potentilla pacifica)*
(3) western dock *(Rumex occidentalis)*
(4) bullrush *(Scirpus validus)*
(5) three-square rush *(Scirpus americanus)*
(6) *(Scirpus maritimus)* robustus
(7) brass buttons *(Cotula coronopfolia)*
(8) paintbrush orthocarpus *(Orthocarpus castillejoides)*
(9) dodder *(Cuscuta salina)*
(10) salt grass *(Distichlis spicata)*
(11) alkali grass *(Puccinellia maritima)*
(12) jaumea *(Jaumea carnosa)*
(13) milkwort *(Glaux maritima)*
(14) marsh clover *(Trifolium willdenovii)* wormskjoldii
(15) glasswort marsh sapphire *(Salicornia virginica L.)* ambigua, pacifica
(16) lileaopsis *(Lileaopsis occidentalis)*
(17) sand spurry *(Spergularia macrotheca)*

(18) sand spurry *(Spergularia canadensis var. occidentalis)*
(19) sand spurry *(Spergularia macrotheca)*
(20) saltbush *(Atriplex patula var. hastata)*
(21) salt rush *(Juncus leseurii)*
(22) spike rush *(Eleocharis parvula)*
(23) spike rush *(Eleocharis parishii)*
(24) spike rush *(Eleocharis macrustachya)*
(25) sedge *(Carex lyngbyei)*
(26) tufted hair grass *(Deschampsia caespitosa)*
(27) sego pondweed *(Potomogeton pectinatus)*
(28) eelgrass *(Zostera marina)*
(29) seaside plantain *(Plantago maritima)*
(30) gum plant *(Grindelia integrefolia D.C.)* stricta D.C.
(31) creeping bent grass *(Agrostis alba)*

The tidal marsh also contains associated coastal fresh marsh communities occurring inland of the salt marsh community. This would include the surgeplain marshes, those wetlands formed by the action of high tides damming both normal and high flows from the coastal rivers. The vegetation of surgeplain marshes generally includes cattails, bullrush and sedges. The Beaver Creek marsh and most of the Columbia River marshes are wetlands of this type.

Physical Characteristics: As has been stated previously, the marsh community extends from bare silt and mud through several successional stages in the low marsh (the area inundated by the daily tides), and the high marsh (the area inundated during peak tides and storm tides), to the line of landward vegetation (in Oregon's estuaries, generally the Alder and Sitka spruce line).

The marsh types differ according to the sediment in the tideflats where they occur. Most Oregon estuaries contain silty tideflats, with the exception of the Sand Lake, Coquille and Siuslaw estuaries (Jefferson, 1973).

The change of Oregon's coastal shoreline by the expansion of tidal marsh in the estuaries is termed progradation meaning "an increase of land area at the expense of the sea by deposition along a shoreline" (Bloom, 1969). Marsh progradation is currently taking place in all Oregon estuaries where sedimentation is occurring (with the exception of Alsea Bay). The opposing process, marsh retrograding, is occurring in some locations, often because of disturbance of flow patterns by man's activities.

The two major physiographic features of the tidal marsh are the meanders of creeks and channels, and the "salt pans"

or evaporation basins of salt water which do not drain after being flooded at extreme high tides. These areas often have different sediment, salinity and temperature characteristics than surrounding areas in the marsh.

Biological Characteristics: Approximately 70 species of plants have been identified as true salt marsh plants in Oregon estuaries (Jefferson, 1973). There also are numerous wetland plants which grow in the areas of fresh water influence in the estuaries, both in the surgeplains and in the floodplains. Each of these areas have a complement of animals, from single-celled life forms to mammals, which depend on the local wetland environment.

Besides the basic function of producing food energy used in the estuary and marine ecosystem, the most important biological characteristic of the tidal marsh is its significance as a transition zone between different habitats. As the estuary is the zone where land and sea meet, so the tidal marsh is the actual location where that meeting takes place.

The low marsh, the area wetted twice daily by the high tides, contains a plant and animal community which is estuarine and at least moderately tolerant to salt and brackish water. The high marsh community, while still tolerant to some concentrations of salt in the soil solution, generally exhibits more fresh water and upland characteristics. These two areas are, however, inter-related, and each community may respond to a natural or man-caused disturbance of the other type.

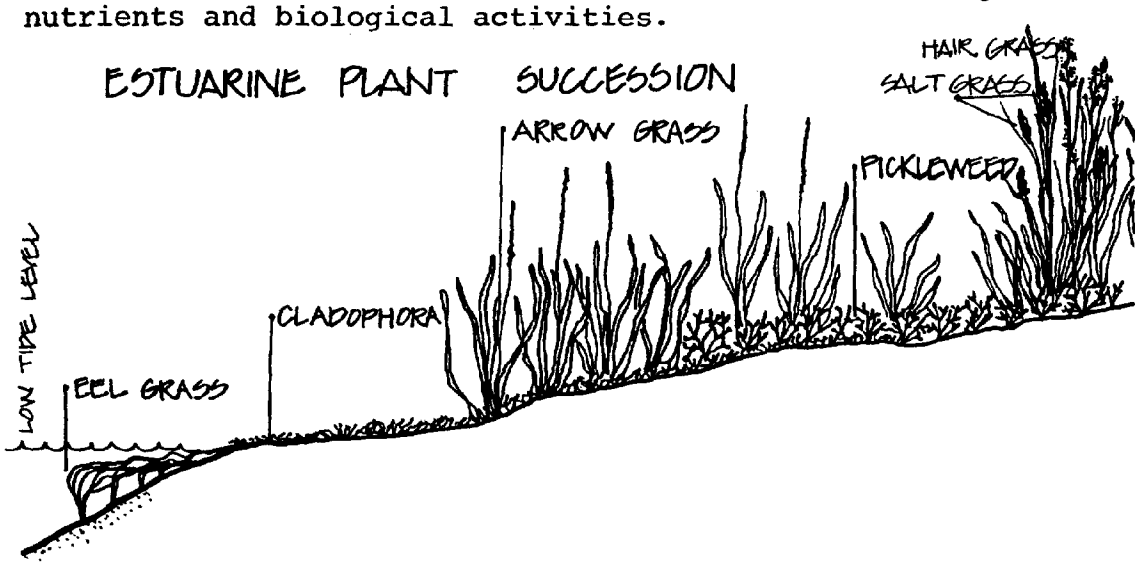
The lower marsh provides food and shelter to the animal communities of the estuary waters. The great numbers of algae (including eelgrass) in the area provide a basic source of food energy. Diatoms (small to microscopic one-celled plants enclosed with shells of silica) occur in great numbers and are able to survive during low tide on, and just under, the surface of mud in the marsh. Intensive siltation in a marsh and mudflat area, however prevents photosynthesis* in these plants and a resultant reduction in the basic food energy available to the marine environment.

**Succession, the orderly and progressive replacement of one natural community by another, is a basic phenomenon in tidal marshes. The tidal marshes of the Oregon coastal zone exhibit consecutive successional zones proceeding inland from the mean lower high water (LHW) tide level. Each of these

*The transformation of solar energy into food energy in green plants.

**This section prepared by Carol A. Jefferson.

zones have specific tolerances for environmental factors such as tidal scour, salinity levels, inundation or drainage, nutrients and biological activities.



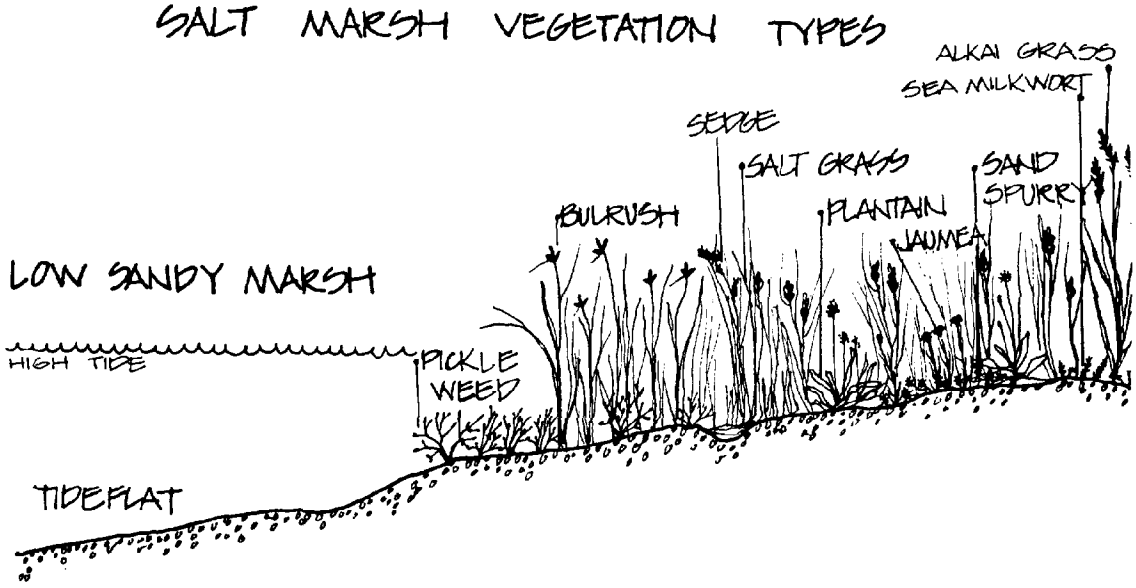
The first stage in succession, colonization of the tideflats by pioneer plants, is determined by the type of tideflat sediment. The succession process on a muddy tideflat differs from that on a more sandy tideflat. After a buildup of silt and organic deposits, a sufficient base is available for the establishment of attached plants. On mud, seaside arrow grass *(Triglochin)* is the first colonizer; on sand it is glasswort *(Salicornia)*. Other plants become established as part of this pioneer community (including the sand spurry *Spergularina marina* and the spike rush *Eleocharis paryula* on mud, and on sand, another species of sand spurry *Spergularia canadensis* and the three-square rush *Scirpus americanus*).

After this community is well established, the area is invaded by salt grass *Distichlis spicata* and sedge *Carex Lyngbyei*. After die-back of some of the original colonizers, the area is invaded by the third stage of plants, including tufted hair grass *Deschampsia caespitosa*, more sedge and eventually some salt rush *Juncus leseureii* in the hummocks, or higher parts of the marsh.

Each stage of the succession process brings about an increase in the height of the marsh, and as a result, a new set of environmental factors. For this reason tidemarshes in the Oregon coastal zone have been mapped and described on the basis of marsh subtypes containing these different environmental characteristics all of which have definite management implications.

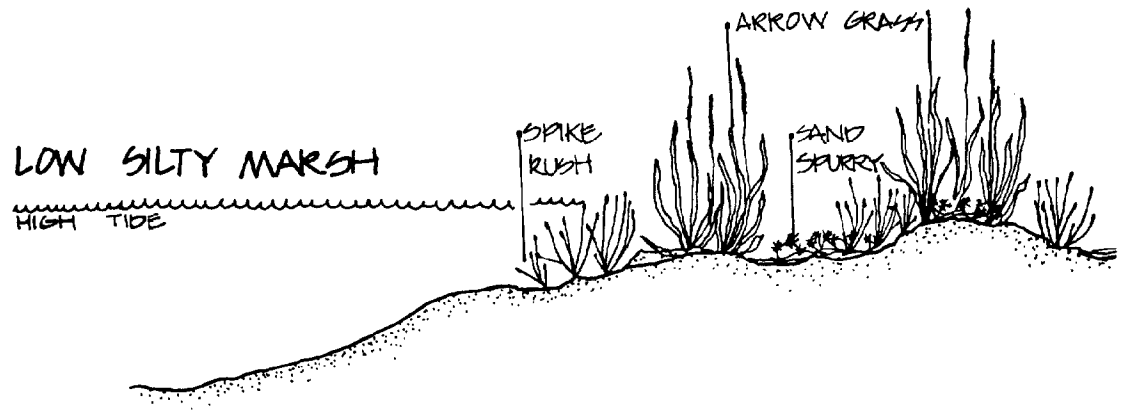
These marsh subtypes are depicted on small-scale estuary maps in the "Description of Individual Wetland Areas" section of this report, and include:

Type I: Low Sandy Marshes. These marshes are usually located on a sandy substrate on the inland side of baymouth sand spits or on islands in sandy bays. In the east side of the Coquille estuary, the large area of this type of marsh is, however, on a silty substrate opposite the sand spit, thereby indicating that another factor besides sand influences formation of this type. The marsh surface is slightly elevated above the tideflat and has a gentle upward slope toward land.



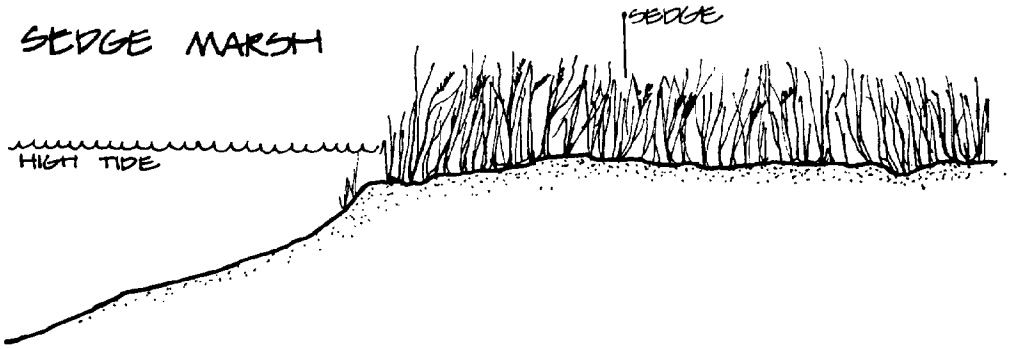
These areas are flooded by nearly all high tides and tidal drainage is diffuse. The lowermost vegetation is dominated by glasswort *Salicornia virginica*, or three-square rush *Scirpus americanus* and the higher vegetation is mainly salt grass *Distichlis spicata*, Jaumea *Jaumea carnosa* and seaside plantain *Plantago maritima*. Lesser quantities of the sand spurries *Spergularia canadensis*, *S. macrotheca*, alkali grass *Puccinellia maritima*, sedge *Carex lyngbyei* and milkwort *Glaux maritima* appear frequently.

Type II: Low Silty Marshes. These marshes are usually located on a silt or mud substrate wherever sedimentation occurs rapidly. The marsh surface is relatively flat but is interrupted with slightly elevated circular islands of colonizing seaside arrow grass *Triglochin maritima*.



These marshes are inundated by nearly all high tides and tidal runoff is diffuse but somewhat channelled around the plant colonies. The smaller plants, spike rush *Eleocharis parvula* and sand spurry *Spergularia marina*, are scattered on the marsh surface.

Type III: Sedge Marshes. Sedge marshes occur usually on silt between the low silty type marshes and more mature marshes or on the edge of island, deltas and dikes. The surface is relatively level but may be abruptly raised a foot or more above the tideflat surface.



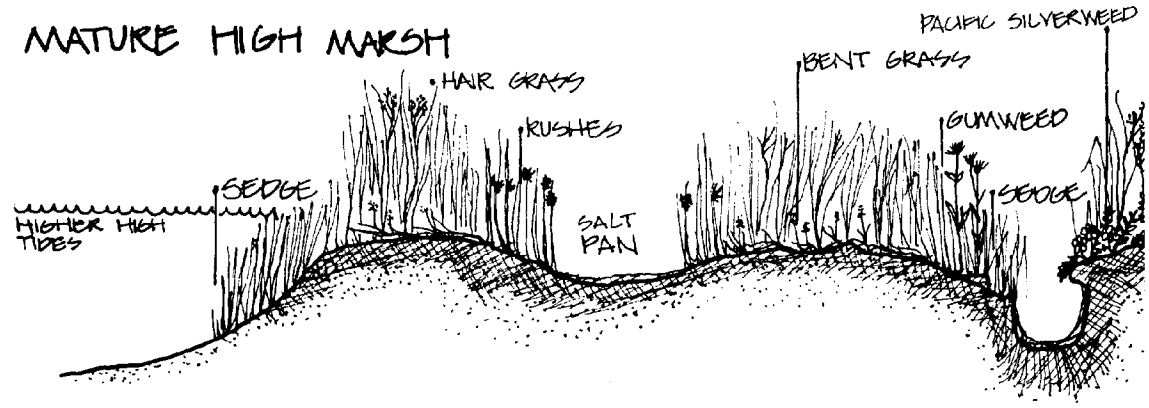
Most high tides inundate the sedge marshes and tidal runoff is diffuse on lower sedge marshes to well contained in deep ditches on older, higher marshes. The vegetation is almost exclusively sedge *Carex lyngbyei*.

Type IV: Immature High Marshes. Immature high marshes usually occur on substrates high in organics and silts and inland of sedge and low sandy marshes. The marsh surface is relatively level, but is interrupted with shallow bare depressions and drainage ditches. The marsh usually rises abruptly two feet or more above the tideflat or several inches

above the surrounding lower marsh. Immature high marshes are inundated by many higher, high tides. Tidal runoff flows in deep, well defined ditches.

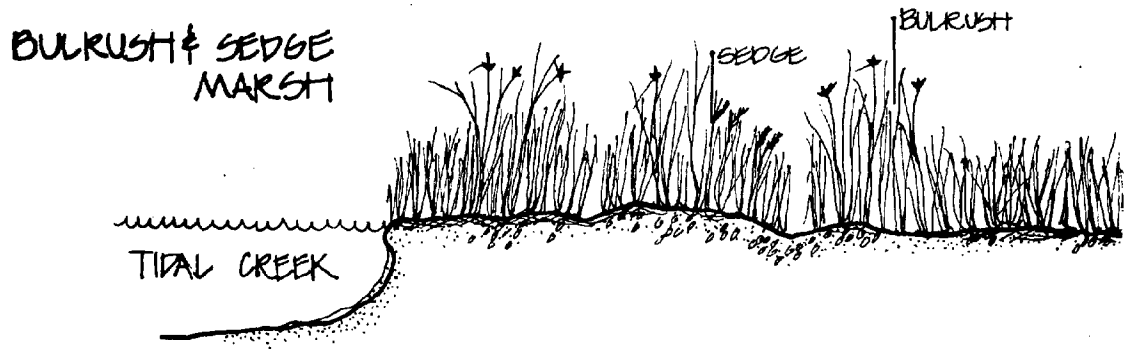
The vegetation present is mixed, because this type is a transition type between lower, immature marshes and mature salt marshes. The vegetation cover is continuous. Tufted hair grass *Deschampsia caespitosa*, a tall grass, is often mixed with salt grass *Distichlis spicata*, a shorter grass, as a co-dominent. Lesser quantities of seaside arrow grass *Triglochin maritima*, glasswort marsh samphire *Salicornia virginica* and sedge *Carex lyngbyei* are also present.

Type V: Mature High Marshes. Mature high salt marshes occur on highly organic substrates which often overlay old clays. The marsh surface is relatively level but is interrupted by shallow depressions and deep ditches and potholes. The marsh rises three feet or more above the tideflat. Many higher, high tides just cover the surface of the marsh. Tidal runoff follows the ditches. Fresh water may seep through the soil.



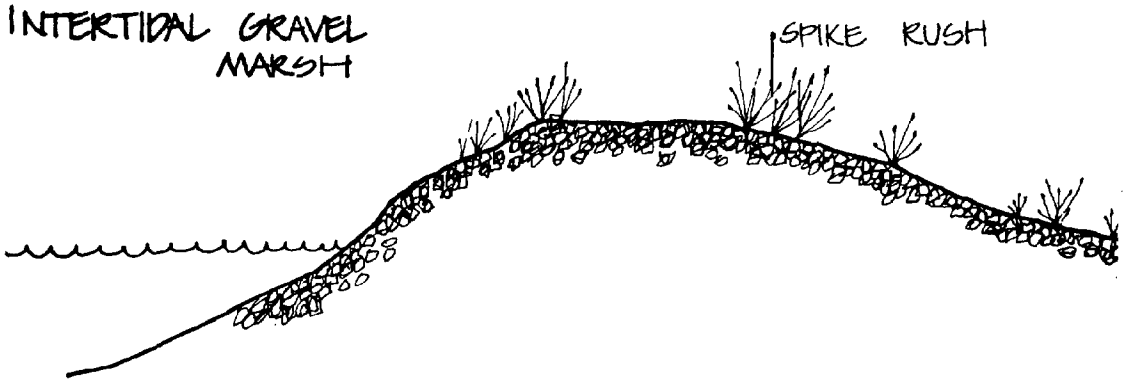
The plant cover is continuous and is characterized by grasses, rushes and forbs. Tufted hair grass *Deschampsia caespitosa*, salt rush *Juncus leseurii* and creeping bent grass *Agrostis alba* dominate. Remnants of earlier plant populations remain scattered across the surface and along ditches. Gum plant *Grindelia integrefolia*, Pacific silverweed *Potentilla pacifica* and salt bush *Atriplex patula* are forbs found on the highest elevations.

Type VI: Bullrush and Sedge Marshes. Bullrush *Scirpus validus* and sedge *Carex lyngbyei* characterize this type of salt marsh. Such marshes occur along tidal creeks and dikes or on islands where fresh water largely dilutes the salt water. As the water becomes fresher upstream, the sedge disappears.

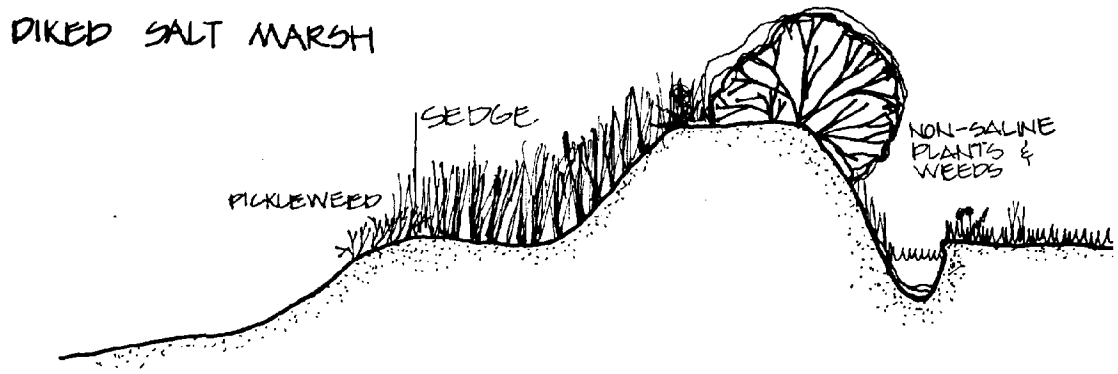


Bullrush and sedge marshes occur on silt or sand that is inundated by most high tides. Tidal runoff is diffuse.

Type VII: Intertidal Gravel Marshes. This type of marsh occurs only near the mouths of the Rogue and Coquille Rivers. Patches of spike rushes *Eleocharis machrostachya*, *E. parishii*, *E. parvula* and scattered forbs grow on gravel bars and beaches subject to tidal inundation. However, the type of plants present indicate that water salinity is probably very low.



Type VIII: Diked Salt Marshes. Successfully diked salt marshes are usually of the types IV and V. Diking reduces the surface runoff and soil salinity. Natural ditching is obscured. Non-salt marsh plants and weeds invade the marsh surface.



Inland Wetlands of the Coastal Zone

FORMATION OF INLAND WETLANDS

During the period of glacial melting approximately 6,000 years ago, sand was deposited as the seas moved increasingly inland. The coastal winds moved the sand from the coastline further inland until the coastal mountain front was reached. Extensive sand dunes which have resulted from this process occur on about half of the Oregon coast, in four distinct dune regions (as identified by Cooper, 1958). These are:

(1) the broad, unbroken Clatsop Plains of the north coast, derived from the sediments of the Columbia River;

(2) the smaller and more isolated bay and estuary dunes of Tillamook and Lincoln Counties;

(3) the Coos Bay dune sheet, a broad and extensive sand area extending from Heceta Head to Coos Bay, broken only by the mouths of the Siuslaw and Umpqua Rivers; and

(4) the low flat dunes which occur south of Cape Arago in Coos and Curry Counties, primarily between the Bandon area and Cape Blanco.

In these areas the inland movement of sand blocked the drainage of many smaller streams, forming lakes and ponds. The storage of water in the dunes also elevates the groundwater table in surrounding areas. This causes the formation of bogs, marshes, swamps, and other areas of standing water in the lowlands east of the dunes sheet. There are two major inland marsh areas which have so formed. In Clatsop County, an extensive zone of inland marsh extends along the east margin of the dunes southward from the Columbia River to the Gearhart area. In Coos County a similar marsh zone extends northward from the North Spit of Coos Bay to Tenmile Creek. Many smaller lakes, bogs and marshes are formed in depressions inland from the smaller and more isolated dunes.

Marshes and swamps form on the margins of lakes where water levels frequently flood adjacent lowlands. Because of the steep topography of the Coast Range front, flats on the margins of most coastal lakes are quite limited, and only fringe marshes and swamps occur in these areas. Larger marsh and swamp areas may develop in the floodplains of streams tributary to the coastal lakes. The Dismal Swamp is an example of this type of wetland, occurring along Fivemile Arm of Tahkenitch Lake.

The dunes marsh is a type of wetland unique to the coastal zone. This type occurs in the deflation plain, the depression formed by the removal of sand inland from the foredune. Sand removal proceeds until the moist sand at the water table is reached, where "deflation" or sand removal then ceases. A favorable environment for wetland vegetation is established, as the seasonal water table may be three to five feet above ground surface (U.S. Forest Service, NRA Inventory, 1972). Thus, as the formation of most of the inland wetlands of the coastal zone resulted from the movement of sand, the continued existence of many of these areas is dependent on the storage of waters in the dunes.

Each of the inland wetland types are discussed separately. The inland marsh and deflation plain marsh types are widely distributed and are of primary significance as vegetation types in the coastal zone. Several other types, such as bogs, swamps and riparian vegetation, are of lesser significance, and are discussed as secondary wetland types.

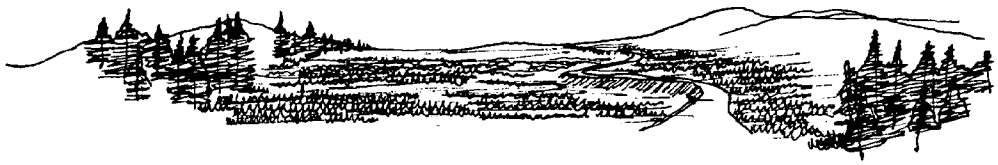
TYPES OF INLAND WETLANDS

Inland Marsh Wetland Type

Definition: Those areas of permanent or temporary shallow* standing or slow moving fresh water characterized by aquatic and semi-aquatic vegetation, the most apparent species being cattails and various species of sedges and grasses.

Physical Characteristics: Inland marshes develop in low-lying areas just inland from the coastal dunes and along the margins of coastal lakes. The soil is generally a soft muck composed of decaying plant material. In the coastal zone the level of the water table (often dominated by water storage in the dunes) determines the location and extent of inland marsh. These marshes may develop in shallow lake basins, eventually spreading across the entire lake, as in many of the lakes along U.S. 101 in Lane and Coos Counties.

Biological Characteristics: The plant life of the inland marsh consists of various species of emergent vegetation (such as reeds and cattails) and numerous algaes and other floating plants. The animal life of the inland marsh is more diverse and abundant than any other habitat type in the region. Snails, crayfish and other invertebrates in the marsh area provide food for several species of game fish in adjacent streams and lakes. Birds are the most apparent wildlife of the marsh area. This habitat type is the critical area in the coastal zone for the production of waterfowl.



Inland Valley Marsh

Location and Extent: Inland marsh occurs primarily in Clatsop and Coos Counties, in the valley lowlands just east of the large dunes sheets. Smaller areas occur on the margins of the large coastal lakes in Lincoln, Lane, Douglas and Coos Counties. The inland marsh is also widely distributed as a "fringe marsh" along the middle and upper reaches of

*The maximum water depth for the development of aquatic vegetation is about three feet (Smith, 1966).

the coastal rivers. Several isolated marshes occur in the valleys of the Coast Range, such as the Fossback Marsh along the North Fork of the Siuslaw River, and the Jeeter and Lost Prairies at the headwaters of the Salmon River in Lincoln County. These areas were probably once much more common. They are, however, often diked and drained, and rapidly become covered with wet meadow or upland vegetation (as is the case with the Fossback Marsh).

The Oregon Wildlife Commission estimates there are 6,348 acres of the inland marsh habitat type in the coastal zone. The distribution of this habitat by county includes:

Distribution of the Inland Marsh Wetland Type

County	Acreage	% of Total
Clatsop	4,608	72.6
*Lane	660	10.4
Coos	1,080	17.0
	6,348	100.0

*Coastal Portion

Dunes Marsh Wetland Type

Definition: Those areas inland from the primary dunes where moist sand near the water table has been exposed providing an environment for a marsh community composed primarily of:

Slough sedge	*Carex obnupta*
Silver weed	*Potentilla anserina*
Bog St. Johnswort	*Hypericum anagalloides*
Creeping buttercup	*Rannunculus flammula*
Western lilaeopsis	*Lilaeopsis occidentalis*

(Franklin and Dyrness, 1969, after Wiedemann, 1966).

Physical Characteristics: The deflation plain marsh (dunes marsh) may exist all year in those depressions where the water table is maintained at a fairly high level during the dry season. In many cases, however, these areas are dry from mid-summer to fall. In winter there is usually shallow standing water in these areas.

Deflation Plain Wetland

Biological Characteristics: The dunes marshes are "pocket wetlands" aquatic and semi-aquatic environments surrounded and overshadowed by the high shifting dunes and forest vegetation. These areas are particularly interesting and significant because of the diversity of plant and animal communities situated within a small area. The marshes usually grade into willows and shorepine providing numerous "edge environments", or contacts between two different habitat types.

The dunes marsh environment of the central Oregon coast provides critical habitat for 61 species of birds, 17 mammals, 5 amphibians and 2 reptiles. The areas are particularly important for wintering 49 species of waterfowl shorebirds and wading birds (U.S. Forest Service, NRA Inventory, 1972). The deflation plain along South Jetty Road (of the Siuslaw River) in the Oregon Dunes National Recreation Area has become known for the impressive flock of Whistling Swans wintering in the area.

Because of fluctuating water tables and constant deposition of wind-blown sand, dunes marshes often succeed rapidly to upland vegetation. The dunes marsh may become an open Lodgepole pine forest, a wet shrub swamp, or a rush meadow (Franklin and Dyrness, 1969, after Wiedemann, 1966). Much of the dunes marsh area of Clatsop County is succeeding to a shrub swamp or wet shrub community, a habitat type of lesser value to wintering wildlife. Cooperative measures are being taken by local officials and the Oregon Wildlife Commission to reduce the growth of shrub swamp and retain the dunes marsh character of the area (as much as possible considering the natural succession process).

Location and Extent: Dunes marshes are found throughout the sand dune regions of the Oregon coast, especially in Clatsop and Coos Counties. The specific location and extent of these areas have not been identified for the coastal zone. The *Oregon Dunes National Recreational Area Inventory* identifies the deflation plain areas of western Coos, Douglas and Lane Counties.

(Note: The following wetland categories are discussed here as wetland types of secondary significance. They have specific values as vegetation habitat types, and are often of major importance to local areas in the coastal zone. They are, however, of lesser significance on a coast-wide basis, except in individual cases of scientific interest or provision of critical habitat.)

Lakes and Reservoirs Wetland Type

The shallow waters of lakes and reservoirs provide feeding areas for waterfowl and wading birds, and support a variety of reptiles, amphibians and mammals. These open water areas are particularly important to waterfowl during the spring and fall migrations. Many waterfowl also winter in the coastal zone, and the lakes and reservoirs are critical habitat during that season.

The Oregon Wildlife Commission estimates there are 11,930 acres of the lake and reservoir wetland habitat type in the coastal zone.

Distribution of the Lakes and Reservoirs Wetland Type

County	Acreage	% of Total
Clatsop	600	5.0
Tillamook	208	1.7
Lincoln	950	8.0
*Lane	4,491	37.6
*Douglas	2,731	22.9
Coos	2,620	22.0
Curry	330	2.8
	11,930	100.0

*Coastal Portion

Riparian Vegetation

Species of vegetation (such as willow and alder) which are dependent on the water but are upland rather than aquatic or semi-aquatic in nature are termed riparian. These plants form the boundary between the wet vegetation and upland environments, and are of primary importance as an "edge", providing cover for animals living in and moving through both the upland and wet vegetation environments bordered by the riparian species.

The Oregon Wildlife Commission estimates there are 25,815 acres of riparian vegetation in the coastal zone.

Distribution of the Riparian Vegetation Wetland Type

County	Acreage	% of Total
Clatsop	3,152	12.2
Lincoln	30	.1
*Lane	10,330	40.0
*Douglas	8,547	33.1
Coos	2,138	8.3
Curry	1,620	6.3
	25,815	100.0

*Coastal Portion

Wet Meadows

Wet meadows are areas of waterlogged soil, generally without standing water in the summer but flooded with shallow water in the winter, which are characterized by various sedges, cone flowers and skunk cabbage. In the coastal zone these areas are often located on broad marine terraces, such as the Tillamook Valley and the Coquille Flats. These areas are usually former salt marshes which have succeeded into mature, more upland forms, or more likely, were diked and drained to provide pastureland for dairy cattle. The Oregon dairy industry developed to a large degree as a result of the drainage of tidal marsh areas.

Wet meadows are important as feeding areas for certain species of ducks and geese. Birds finding shelter and protection in coastal marshes often feed in wet meadows.

The Oregon Wildlife Commission estimates there are 5,810 acres of wet meadows in the coastal zone.

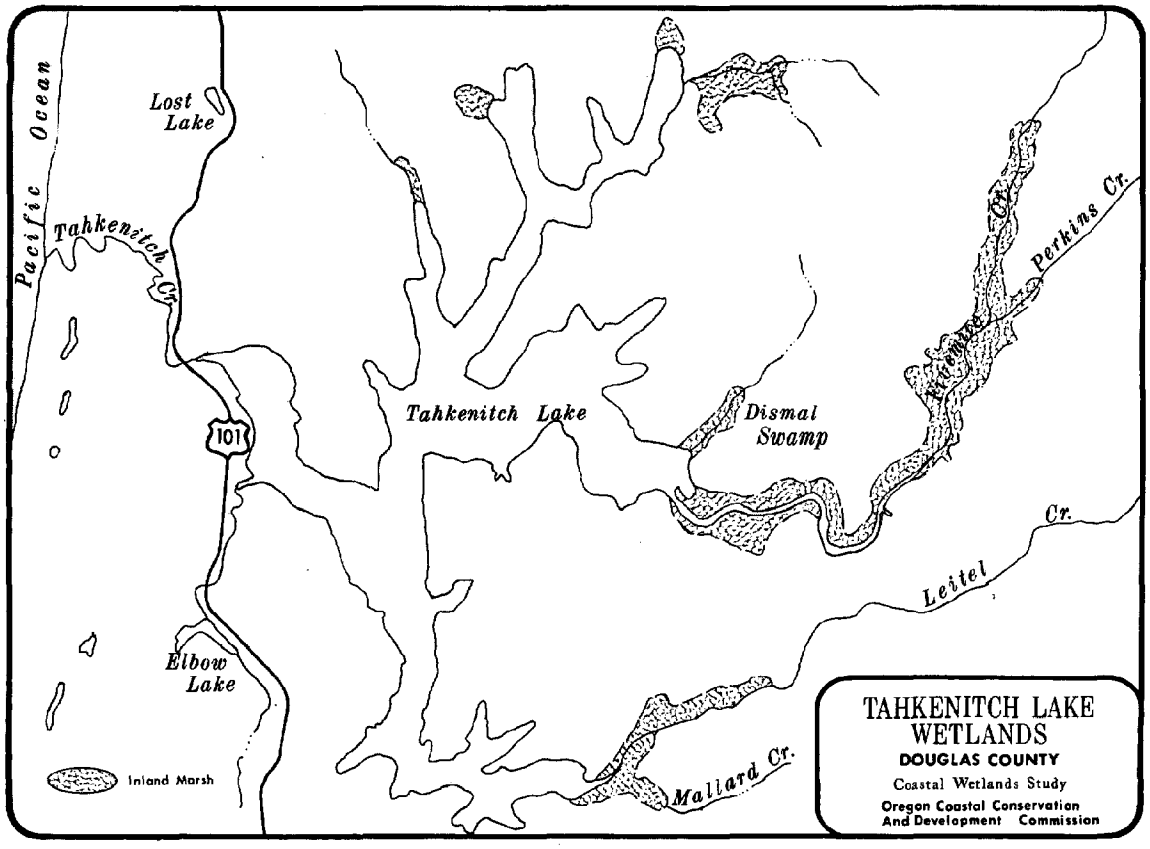
Distribution of the Wet Meadow Wetland Type

County	Acreage	% of Total
Lincoln	370	6.4
*Douglas	1,140	19.6
Coos	3,840	66.1
Curry	460	7.9
	5,810	100.0

*Coastal Portion

Bogs

Bogs are waterlogged areas of peat and muck soils characterized by various moss and sedge species, and also



cranberries. Bogs often occur in proximity to marshes, but differ in that bogs contain thick beds of moss which support woody plants. Bogs are often the last stage in the progression of a lake to a Sitka spruce woodland. The bog is a nutrient-poor environment, and in the coastal zone, exhibits plant species (such as the *Darlingtonia*, or Pitcher Plant) which have developed insect-catching techniques to secure nutrients.

Bogs have formed where the movement of water in small streams and springs has been halted, forming pools where sediment and debris may collect. The movement of the dunes sheets in Clatsop, Lane, Douglas, Coos and Curry Counties have provided opportunities for bogs to form, and many of these areas are familiar to coastal residents for cranberry production and the ground fogs of the early morning hours.

Bogs are the least significant wetland habitat type, and as food energy or wildlife production areas are of little coast-wide significance. They are, however, of great value and interest as scientific natural areas. Bogs are sensitive indicators of climatic change in the post-glacial period, a subject of considerable interest to many scientists studying the coastal environment (Deevey, 1958). Additionally, they exhibit unique, specially-adapted plants, and are excellent locations to study the adaption of plants and animals within a special, geographically-limited ecosystem. Bogs significant for scientific purposes will be discussed as part of the OCC&DC report on scientific natural areas.

Swamps

Swamps are wetland areas characterized by woody vegetation, rather than by the reeds and rushes of the marsh areas. They are generally fringe or transition areas on the upland margins of marsh, floodplain, and lake areas. The Dismal Swamp, which occurs upland from the Fivemile Creek Arm of Tahkenitch Lake is an example of a fresh water swamp. Because of the vegetation characteristics of these areas, they are often regarded as riparian or upland habitat types.

Swamps are important for the seasonal storage and release of surface and ground waters, and provide valuable habitat for wildlife, both for production and for wintering.

WETLAND FUNCTIONS AND VALUES

A basic goal of coastal resource management is to assume the maintenance of a healthy and functioning physical and biological system in the coastal zone. This concept in no way implies that maintaining natural functions and values is more important in every location than the uses man makes of these environmental resources. It does imply, however, that maintaining these functions and values in the overall coastal environment is necessary for the long-term use and enjoyment of coastal resources. Activities which seriously deteriorate the natural system reduce the capacity to sustain human activities.

In regard to wetlands, management experience from other states indicates that estuaries, tidelands, marshes, bogs, and other wetland types are usually managed as resources of state-wide concern. In the Atlantic states wetlands management often

has been the primary concern in establishing a coastal zone management program. In these cases, the inherent functions and values of wetland areas have formed the basis for management guidelines. In a recent address, the Vice-President of the Wildlife Management Institute of Washington, D.C., emphasized this approach to management by stating that one way or another wetland values affect every taxpayer in the United States (Jahn and Trefethen, 1973).

The major functions and values of wetlands as described include:

(1) food energy production and nutrient cycling;
(2) production of fish and wildlife;
(3) prevention of siltation and erosion;
(4) absorbtion of pollutants; and
(5) moderation of water temperature.

Yaquina Bay Estuary and Associated Wetlands

Production of Food Energy and Nutrient Cycling

The estuary, including shallow water areas, tideflats, eelgrass, and marshes, is one production unit. In the same manner, inland wetlands are an integral part of the food chain of the lake, floodplain, stream, and groundwater environment of the region. These coastal wetlands are among the most productive natural systems known to exist. Although productivity studies have not been conducted in Oregon coastal wetlands, it might be assumed that production here is of greater relative importance because of the limited extent of these areas in coastal Oregon.

Wetland plants in general and marsh plants in particular are important in the aquatic food chain because solar energy, carbon dioxide and water are converted into carbon compounds in plant chlorophyl and because nutrients (such as phosphorous and nitrogen) are assimilated and converted into compounds usable by a wide range of organisms.

The marsh is a particularly important location within the production system because:

(1) large quantities of detritus (organic debris resulting from plant death) wash into the estuary with daily and seasonal high tides;*

(2) the individual segments of plant debris form a surface on which small life forms cling, providing a more concentrated source of food energy for feeding organisms (i.e., particles of detritus after colonization by bacteria may have a protein content twice as great or more than that of the original particle (Teal, 1962)); and

(3) algae production may be higher in marshes than in the open waters of the estuary because of less turbidity (Odum, 1961).

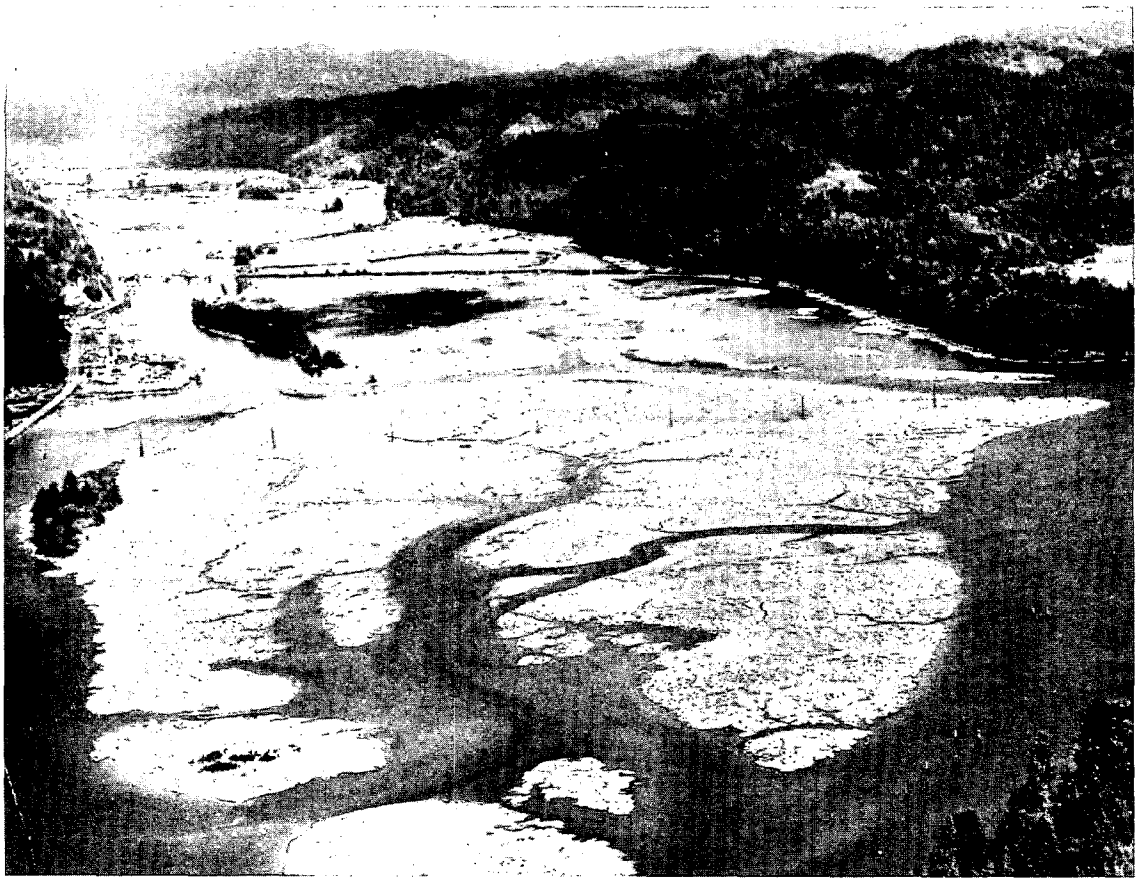
*Odum and de la Cruz in Lauff, 1967, state that "...organic detritus is the chief link between primary and secondary productivity, because only a small portion of the marsh grass is grazed while it is alive. The main energy flow between ...levels is by way of the detritus food chain."

Primary phytoplankton production takes place in the shallow waters of the estuary. A particularly important type of energy production takes place on the tideflats through the interactions of a variety of plant and animal forms. This production occurs on the wet surface as well as within the sediments. As stated recently by a zoologist, "...a muddy shore is unique amongst environments in having these two productive layers, one on the surface and another a few centimenters below the ground" (Eltringham, 1972).

The major primary producers are diatoms, single-celled algae. The presence of these plants is at least partially determined by the type of sediments present and the amount of organic material in the soil (Eltringham, 1972), once again demonstrating the interrelationship of physical and biological factors in the estuarine environment. Other primary producers include eelgrass (*Zostera*) and other algaes such as *Cladamorpha*. Of major importance also is the vast amount of nutrients brought in from the watershed by the coastal rivers.

The marsh is of special importance because considerable amounts of decayed material is released to the estuary environment, and an optimum location for production by other plants is provided. In this regard, Eltringham (1972) observes that

> *thus, between them, the algae and the higher marsh plants are able to maintain an uninterrupted sequence of photo-synthetic activity which must make the saltmarsh one of the most productive of all intertidal areas.*



Cox Island - Siuslaw River
(Numerous Channels, Ditches and Island Clumps
Indicate a High Probable Production value)

A detailed discussion of the importance of wetland productivity is beyond the scope of this report. However, some conclusions from existing information may be used in that:

(1) the "low marsh" areas are more closely related to the estuary and marine food web on a daily basis, while the "high marsh" areas are important to the system on a seasonal basis by providing much of the essential detritus, or decayed plant materials;*

(2) the food web depends on the inter-relationships of a variety of wetland types;

*See Bella, 1973, p. 28, for a discussion of the importance of timing of activities in the estuary environment.

(3) the total *amount* of organic material produced may be related to the *amount* of production of fish and wildlife useful to man;* and

(4) productivity may be affected by changes in the watershed as well as in the immediate vicinity.

In recognition that approximately two-thirds of all coastal and marine fish and shellfish harvested are dependent on the estuary wetland ecosystem, Dr. Eugene Odum, a prominent Atlantic coast wetlands researcher, has developed the concept of a "marsh bank", a joint public and private effort to protect the food production function of the coastal environment. A discussion of productivity in the coastal environment is included in the appendix of this report. Although the discussion is from a report on Atlantic wetlands, many of the concepts are applicable to wetlands management on the Pacific coast.

*Dr. Joel Hedgepeth, in Lauff, 1967, quotes research from different areas which establishes a correlation between the organisms present and gross plant production, although the applicability of the research to other areas is not accepted without question.

Fish and Wildlife

Besides sustaining estuary and marine life through a complex food web, wetlands provide food and shelter directly to a great number of fish and wildlife. Clams, oysters, and crabs depend on the total production unit of the estuary made up of tideflats, eelgrass and marshes. Some fishes depend on eelgrass and marshes for food, protection and spawning areas. The most visible symbols of wetland importance are mammals such as the beaver, muskrat and otter, and diverse species of birds. Oregon's coastal wetlands are particularly important to the migratory waterfowl of the Pacific Flyway. Many species depend on estuarine habitats for the wintering season (eelgrass is particularly important to Black brant). An estimation of the numbers of birds using coastal wetlands is provided by winter inventory of waterfowl conducted each January by the U.S. Fish and Wildlife Service.

January Waterfowl Inventory, Oregon Coast 1969-1972

County	Total Ducks and Geese					
	1969	1970	1971	1972	1973	Average
Clatsop	4,192	6,204	7,345	8,691	8,754	7,017.2
Tillamook	6,701	5,667	10,118	9,521	13,047	9,010.8
Lincoln	2,631	3,571	13,519	6,946	7,409	6,815.2
Coos	20,997	16,330	15,280	34,662	N/A	21,817.25
Curry	590	2,876	N/A	5,623	N/A	3,029.66
TOTAL	35,111	34,648	46,162	65,443	29,210	42,114.8

Coastal wetlands provide habitat for many types of birds other than waterfowl.

While inland marsh and dunes marsh environments are equally significant for wintering waterfowl, the inland marsh areas are additionally notable for the production of aquatic birds and mammals in the spring and summer.

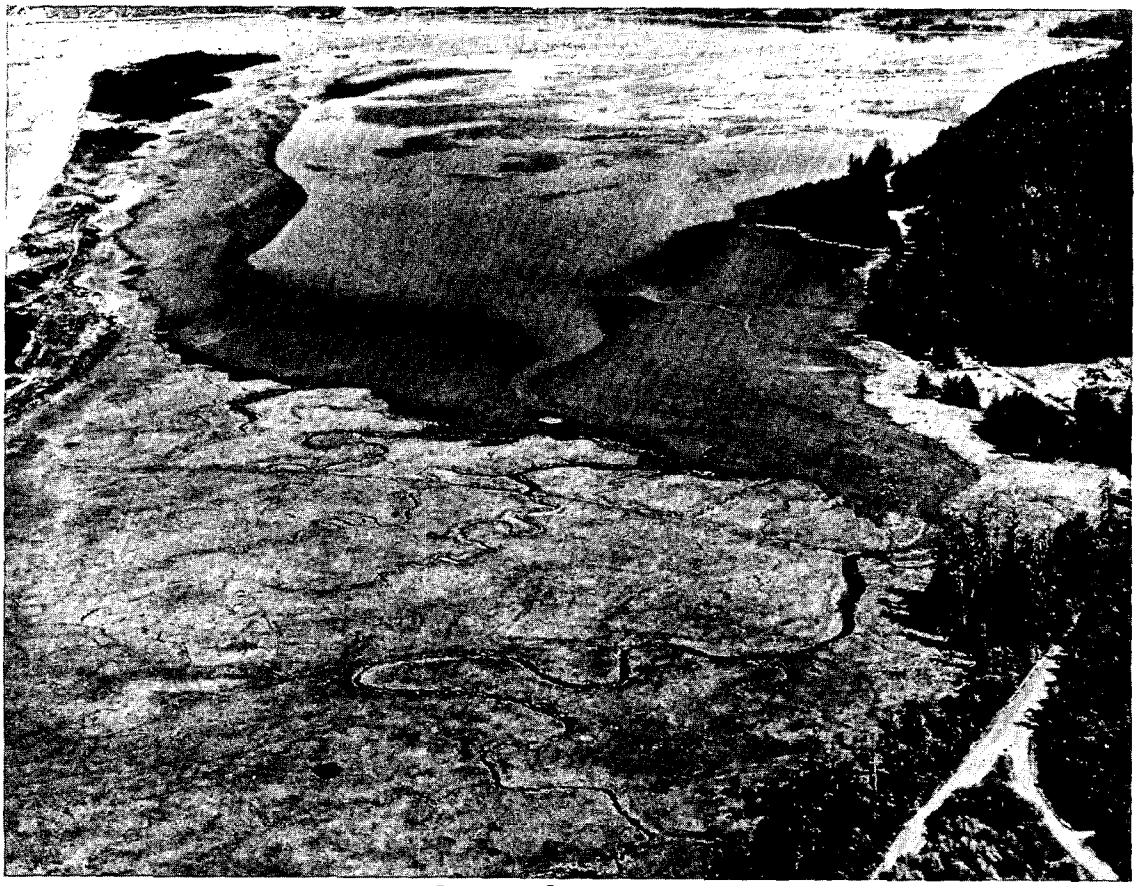
Information on the fish and wildlife of wetland areas is provided in the Description of Individual Wetland Areas section of this report.

Great Blue Heron - North Fork of the Siuslaw

Erosion Control and Water-Storage

As has been discussed previously, marsh vegetation accelerates the settling of silt and other debris from river and estuary waters. This function has particular significance in estuary areas where shellfish and other marine organisms may be disturbed or destroyed by heavy siltation. Additionally, undisturbed marshes may prevent silt from entering navigation channels.

Wetland vegetation, particularly dense stands of marsh, act as a buffer for storm tides and waves, easing the potential of erosion. Marsh vegetation is a natural stabilizer of stream and channel banks, and the marsh acts to stabilize shifting river and tidal channels, lessening the potential for destructive erosion during high water flows.



Wetlands of Netarts Bay

Since marshes absorb and release water slowly, they moderate the rise of the tide upstream and the fall of the tide downstream. Fresh marshes often recharge streams and the groundwater table through the gradual release of water in the summer dry season.

The buildup and consolidation of clay particles in the marsh also forms an impermeable layer which aids in preventing infiltration of brackish water into the fresh groundwater table.

Pollution Control

Wetlands are extremely important as natural purifying agents of water. In a recent Wildlife Management Institute study of wetlands, researchers James G. Gosselink, Eugene P. Odum, and R. M. Pope developed an economic evaluation of marshes. Marsh value was established at approximately

$4,000 per acre, of which $2,500, or almost two-thirds, was derived from waste assimilation capacity.

Another recent study demonstrated that a 1,500-acre Florida marsh can remove all the nitrogen and 25% of the phosphorous from the sewage of 62,000 people (Jahn and Trefethen, 1973). The 512-acre Tinicum Marsh near Philadelphia (which was receiving domestic sewage from treatment plants) absorbed phosphorous at a rate of 5 tons per day and ammonia at 4 tons per day, and in return, produced 20 tons of oxygen per day.

Of course, each wetland area has a certain capacity for waste assimilation. To exceed the capacity would be to deplete the oxygen needed for a balance of biological activity, and possibly to set off other undesirable changes. Also, many coastal rivers carry a heavy load of oxygen-depleting nutrients, including wood waste and runoff from agricultural fields. Other factors such as tides and currents may affect the

Diking and Grazing Activities on Salt Marsh
Siuslaw River

assimilation capacity of a marsh area, so that the presence of marsh vegetation is no assurance that effluent will be absorbed in a given location.

The potential impact of domestic sewage and other organic wastes on wetland areas is a management concern in the Oregon coastal zone. Many communities in the estuary areas are currently anticipating development of sewage treatment plants, and past trends indicate wetland areas are the usual location for outfalls. Additionally, septic tank effluent is a common problem in many wetland areas. In small quantitites, the effluent is harmless. In areas of increasing density, however, adverse effects result from the inability of the system to absorb increasing amounts of effluent.

Temperature Regulation

Marshes and the shallow estuary waters trap and hold heat from the sun, providing a tempering influence on cold waters entering the estuary from the sea and from the Coast Range. This function has a major significance in the spawning and growth rates of fish and shellfish in the estuary, and also affects local climatic conditions.

USES OF WETLAND AREAS

In the past, existing use patterns in the wetland areas and adjacent uplands have determined the nature of change in these areas. Because resource management is conducted to benefit man, these uses will continue to be important factors in management decisions. It is the purpose of a management system, however, to assure that these uses are consistent with the need to maintain the natural values of wetland areas.

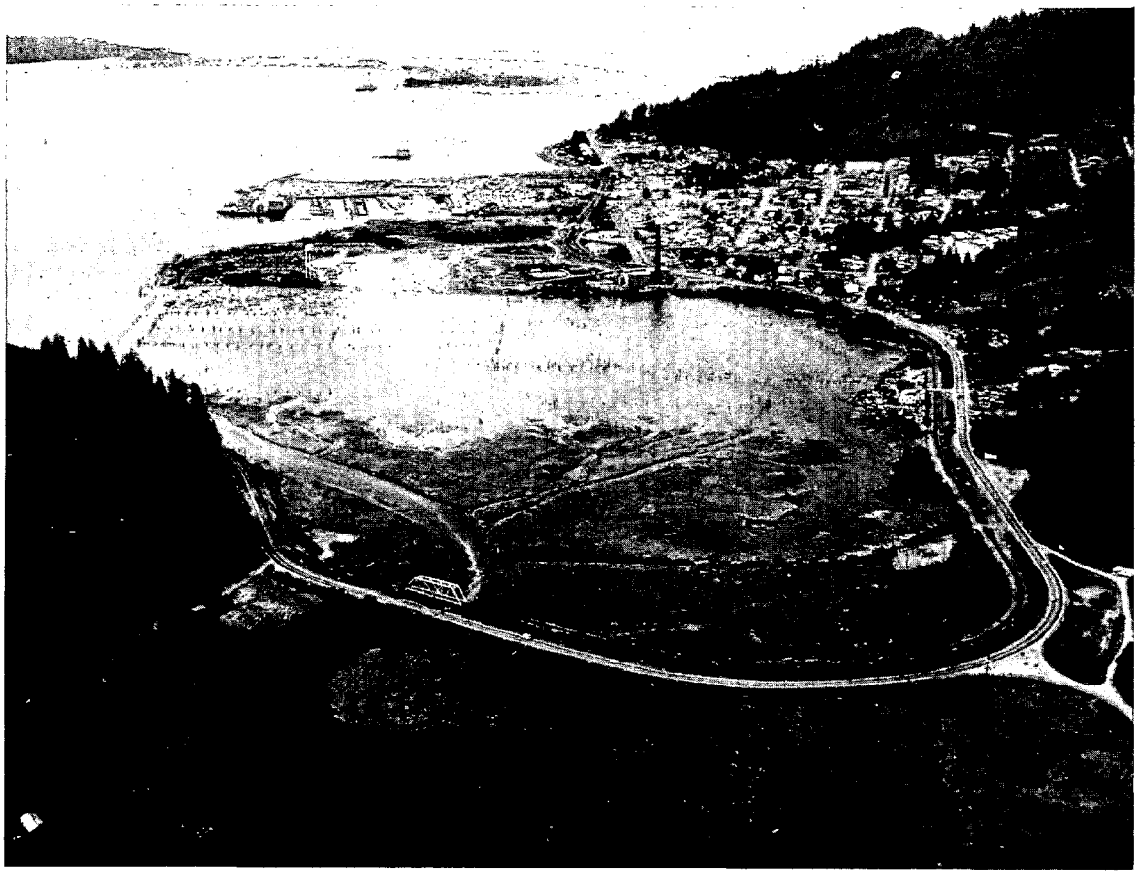
Current Uses

Since Europeans first came to the Oregon coast, agriculture has been the major use of coastal marshes. The dairy industry developed on diked and drained salt marshes,

and grazing and cutting of marsh hay (especially in the mature and immature high marshes) continues to be a frequent use of these areas.

Residential development on fills is an increasing use of the wetlands, as waterfront property becomes more in demand. This has not been a traditional wetland use, however, because of flood hazard and problems of waste disposal related to high water table. Commercial uses have been primarily those related to sport and commercial fishing, although filling for commercial development has occurred frequently in wetland areas adjacent to urban areas.

Wetlands often have been filled to create sites for industrial development, especially lumber processing facilities. Adjacent rivers and estuary waters provide for log transportation and storage, and often the dredging of navigation channels provides spoil for filling the large areas needed for



Miami Cove Wetlands
(Note Diked Areas Lower Portion, Recent Fill just Southeast of Railroad Bridge, City of Garibaldi in Background)

such operations. Additional filling of wetlands with wood waste has been a consequence of the estuary/floodplain location of these facilities. In the urban areas, some filling to create shipping docks and warehouses has taken place.

Hunting for ducks, geese and band-tailed pigeons is a basic recreational use of wetland areas. However, the gathering of clams and crabs is more frequent and extensive. Little information is available regarding the amount of use of wetland areas for birdwatching, individual nature study, and enjoyment of the natural environment. It has been noted that nearly all the 15 million Americans identifying themselves as serious birdwatchers and wildlife photographers in the 1965 national outdoor recreation survey look to the wetland/estuary environment at some time for the unique wildlife and visual experiences available in these areas.

Transportation corridors have traversed wetland areas throughout the coastal zone. Fills for highways and bridges have covered many acres of marsh, but these *direct* impacts are less significant than the subsequent *indirect* impacts resulting from altered circulation patterns, urbanization, and other transportation - corridor activities.

Aquaculture is a common use of wetlands worldwide. In Oregon, Coos Bay, Yaquina Bay and Tillamook Bay are currently used for commercial oyster production. As conducted today, these activities are generally consistent with multiple use of the wetland environment. As aquaculture becomes a more common use of the estuary, however, individual projects will have to be evaluated in terms of demand on existing resources. The level of physical, chemical and biological controls needed for some types of aquaculture might require an exclusive use management approach to parts of the estuary environment.

Suitability of Wetlands for Development

Although wetlands possess natural values of great importance to man, some areas inevitably will be converted to urban uses. It is important to assure that, if such conversions are deemed in the public interest, the developments be appropriate to (1) local environmental characteristics; and (2) regional patterns of resource development. The inventory process being conducted by OCC&DC will provide a perspective on such factors of the local environment as soils, topography, climate, vegetation and land use, as well as regional considerations such as transportation corridors, urban growth trends and land needs for economic development. These factors

are not discussed in this report. However, the nature of the wetlands environment raises serious questions on the suitability of these areas for urban development.

The following table from a recent report issued by the American Society of Planning Officials is an assessment of suitability for urban development of eight major natural areas.

Degree of Intolerance to Human Use		Degree of Suitability for Urban Use
Surface water		Flat land
Marshes	GREATEST	Forest, woodland
Floodplains	↑	Steep slopes
Aquifer-recharge areas		Aquifers
Aquifers		Aquifer-recharge areas
Steep slopes	↓	Floodplains
Forest, woodland	LEAST	Marshes
Flat lands		Marshes

Source: Michael J. Menshenberg, *Environmental Planning 1*, ASPO Report No. 263: Chicago, American Society of Planning Officials, 1970.

As indicated, wetland areas have a low tolerance to urban development activities. This is because of the flooding potential, high water tables, aquifer recharge functions, and the compressible soils characteristic of these areas.

FLOOD HAZARD

As has been discussed previously, tidal marshes are part of the floodplain and surgeplain environment, and as such, are exposed to frequent flooding. Additionally, these areas have more of a potential for intensive and disastrous flooding than any other comparable area because of the possible coincidence of heavy rainfall and runoff with high storm tides, and also because of the threat of *tsunamis*, or seismic shock waves. Filling sites in the floodplain/surgeplain environment to escape these hazards usually intensifies the threat to adjacent areas and activities.

An identification and description of coastal flood hazard areas will be conducted as a part of a separate OCC&DC work element.

Wetlands Occur in Areas of Flood Hazard,
High Water Table, and Unstable Soils.

HIGH WATER TABLE AND AQUIFER RECHARGE

Areas of high water table and aquifer recharge (including immature and mature tidal marshes, inland marshes and swamps, bogs, and dunes marshes) are essential to the groundwater resource. Pollution from septic tanks, drainage from paved areas, and other sources of pollution pose a threat to both local and regional groundwater supplies.

COMPRESSIBLE SOILS

The instability of wetland soils (because of the process of deposition) has been discussed previously. In the earthquake-prone San Francisco Bay region, geologists have questioned the stability of structures on fills during an earthquake. Although this threat is not as great in the Oregon coastal zone, related problems such as differential settling indicate that increased engineering and construction costs are characteristic of these areas.

Classification of Uses

The uses of the wetland areas of the coastal zone may be grouped into two main categories: those uses which are resource-dependent, or related to the inherent functions and values of the wetland area; and those which are resource incidental, not dependent on the natural characteristics of the wetland area.

Resource-dependent uses take place in a wetland area because it is a wetland, and contains specific water, plant and animal resources. These include:

(1) educational uses (scientific research and nature study);

(2) passive recreation (birdwatching, photography, and enjoyment of the natural environment);

(3) active recreation (hunting, fishing and shellfishing);

(4) commercial fishing and shellfishing; and

(5) grazing and harvesting of marsh hay.

Resource-incidental uses are those which are unrelated to the inherent functions and values of the wetland area. These uses may be divided among those which are water-dependent, and those which are displaceable in terms of waterfront location, in that they do not require proximity to the shoreline.

Uses which are water-related, occurring in wetland areas because of shoreland location, include:

(1) marinas and harbors (and attendant boat sales and repair facilities);

(2) marine industrial facilities (including log storage);

(3) navigation (including dredge spoils);

(4) sewage treatment plant outfalls; and

(5) general and ocean-related recreation (campgrounds, parks and public boat landings).

Uses which are incidental to the wetlands resource and unrelated to a shoreland location are very numerous. The major activities of this type include:

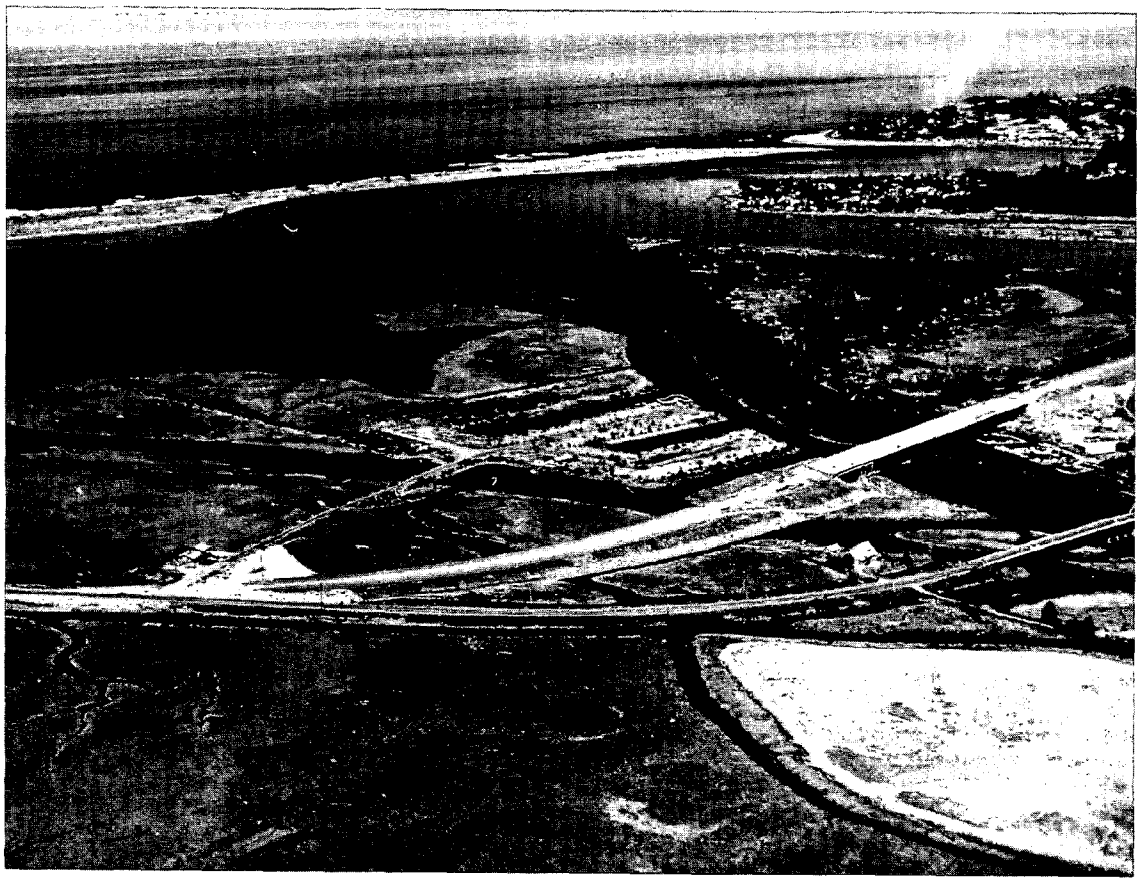
(1) residential development (including single-family, mobile homes, and condominiums);

(2) commercial development (including parking areas);

(3) general industrial and related facilities;

(4) non-water-related recreational;

(5) fills for transportation corridors;



Siletz Bay
(Modifications of the Wetland Area have Resulted from the U.S. 101 Bridge Fill and the Siletz Keys Residential Development)

(6) solid waste disposal (including wood waste);

(7) power lines; and

(8) billboards and other advertising structures.

Use Conflicts

Inherent in the concept of environmental impact is the fact that some uses reduce or eliminate the inherent functions and values of a resource. These uses may be described as resource-conflicting. Other uses sustain inherent functions and values and therefore are resource-compatible.

Relationships also exist between the various uses of the resource. These relationships may be described, as discussed previously, by the terms exclusive use, multiple use and displaceable use.

Exclusive uses are those which conflict with all others. Multiple uses such as fishing, hunting, and oyster production, are those which may take place in the same area, either at the same time or separated by hours or seasons. Displaceable uses are those, as discussed previously, which are not dependent on wetland resources or proximity to them.

Each of these factors may be important in determining the appropriateness of a potential use of a wetland area, or any other natural resource.

Assessed Value of Wetlands

The economic value of wetland areas for incidental uses, those which do not depend on its natural characteristics, is a significant factor in recommending disposition of this resource. In order to determine appraisal procedures, value ranges, and factors affecting both, OCC&DC staff interviewed county assessors from Tillamook, Lincoln and Lane Counties.*

*Phil Smith - Lincoln County; Mort Myers - Tillamook County; George Saunders - Lane County

The assessed valuation of tidelands (low water to high water) and marshlands (high water to positive vegetation line) has remained relatively stable over the past two years. This reflects a lack of market activity due to tighter development restrictions regarding water supply and use of septic tanks.

Wetlands in their natural state have little value for development. They may be used for recreation such as duck hunting and clamming or for pastureland. Development and use to a greater extent requires filling, provision of water and sewer services, and highway access. Accordingly, the appraised market value depends on the services available to the property and the extent to which it is above water during the year.

There appears to be standard value ranges for wetlands depending on existing use, access, water and sewer facilities and potential "highest and best" use. Tideland areas and marshes having little, if any, grazing potential are generally assigned a "minimum value" by assessors of $50 to $100 per acre. In Lane County this minimum value may be as low as $5 per acre. Marshland usable for pasture has a value of $400 to $700 per acre depending on how long cattle can be grazed during the year.

Road access and filling may increase the value to $2,000 per acre. If sewage and water services are available and the property subdivided, value is based on water front footage. This may range from $35 to $150 per front foot along rivers and $300 to $500 per front foot on the bays depending on what is considered the "highest and best use". Residential, marine commercial, and marine industrial are likely high value uses depending on the zoning and experienced demand. It is not uncommon for residential lots on filled marshlands to demand as high a price as $10,000 to $15,000 per lot.

Before the recent restrictions on the use of septic tanks and the source of water, waterfront property values were increasing at approximately 30% per year. With these restrictions, the market value has decreased and become more stable. However, much of the marshland area in the state is owned by private firms or individuals and it can be assumed that several of these holdings are for speculative purposes. Once sewage services are obtainable, and federal money is now becoming available for that purpose, sales and consequent values of wetland areas will begin increasing rapidly.

At present the market value of wetland property is low. For tax purposes, it may be assessed at even a lower value through farm or open space deferrals. Therefore, maintaining this type of property in its natural state is not an appreciable financial burden on the property owner. However, the potential for rapid increase in value exists and should be considered when recommending conservation and development policies for the wetlands resource.

MODIFICATIONS OF WETLAND AREAS

Coastal zone management is often thought of as man's attempt to control the adverse impacts of his use of coastal resources. The impact of a resource use in the coastal zone on the natural resources, and on other uses, often results in a conflict. Thus, consideration of impacts is a key element in resource management.

The two greatest changes in Oregon's coastal wetland areas have come about for greatly different reasons. The conversion of tidal marshes to pasture through diking and draining has been a primary or direct modification of the environment, and has resulted from man's desire to change the nature of the land. The expansion of marshes into the estuaries has resulted from activities in the watershed, not in the immediate wetland environment, and as such has been a secondary, or indirect modification. This distinction is important because in developing management guidelines there is a tendency to overlook the indirect, or secondary impacts of a resource use decision.

In the past, the most significant *primary impacts*, or direct modifications of the wetland environment, have been:

(1) diking and draining for agricultural purposes;

(2) filling for residential, commercial, and industrial development;

(3) deposition of dredge spoils;

(4) storage of logs directly on tideflats and marshes;

(5) refuse and wood waste disposal; and

(6) construction of transportation corridors.

Important *secondary impacts*, or indirect modifications of wetland areas, have resulted from man-caused changes in:

(1) the flow patterns of rivers and estuaries;

(2) water quality (both chemical and biological);

(3) the rates and types of sedimentation;

(4) vegetation patterns because of the activities of introduced plants;

(5) the levels of the groundwater table; and

(6) in the chemical nature of sediments in the tideflats and marshes (primarily through log storage and waste disposal).

Determining the primary and secondary impacts of resource and land uses, and evaluating the consequences on wetland resources in a systematic fashion has been done in a number of states. Possibly the most extensive system of this type is one developed by Jens Sorensen for the California Coordinated Ocean Area Plan. OCC&DC is currently investigating the applicability of this system to Oregon coastal problems.

Impacts on Estuary Wetlands

PRIMARY IMPACTS

A general evaluation of primary impacts on estuaries is available from the 1970 National Estuary Study. In the Pacific Northwest Region, this study listed the following impacts in order of severity:

Impacts on the Estuary

Most Severe

- Domestic Sewage
- Industrial Waste
- Bulkheads, dredge and fill to create land
- River impoundment and flow control
- Diversion of fresh water destined for estuaries
- Seawalls, dikes and levees to prevent flooding
- Channel dredging and spoiling for transportation

Moderately Severe

- Oil pollution

Mining and mineral recovery
Thermal pollution
Pesticide pollution
Solid waste disposal
Ditching and draining

Least Severe

Modify tidal exchange
Salt water barriers to prevent salinity intrusion
Coastal impoundments for fresh water supply
Agricultural waste

These impacts were then related to the uses of the estuaries, and a use-ranking developed to describe which activities were compatible or conflicting with estuarine functions and values in the Pacific Northwest.

Causes of Impacts on the Estuary

Great Impact

Industry
Power production
Urbanization
Waste disposal
Water supply

Moderate Impact

Pest control
Transportation
Recreation

Small Impact

Agriculture and forestry
Commercial fishing
Fish and wildlife
Mining
Research and education
Sanctuaries

Source: U.S. Fish and Wildlife Service, *National Estuary Study*, Volume 2, Washington, D.C., 1969.

SECONDARY IMPACTS

There are two important secondary impacts which must be considered in developing management guidelines. These include

(1) the consequences of continued siltation on estuary wetlands, and (2) the potential expansion of tidal marsh, either naturally or resulting from the introduction of *Spartina*.

Siltation in the estuaries at rates which followed the extensive logging and burning of the Coast Range will probably never occur again. However, these activities have resulted in a level of siltation which has greatly accelerated processes of shoreline change, as described by Johannessen (1961). Additional slight increases in tideflat elevations *may* dramatically increase this process of shoreline change, even though the periods of massive sediment deposit are in the past.

A related problem is the potential of introduced species to change the nature of wetland communities and possibly to accelerate marsh expansion. Various species of *Spartina* (salt marsh cordgrass), probably the most widely distributed salt marsh plant, have been introduced into wetland areas throughout the world primarily for land reclamation. One writer describes the introduction of *Spartina anglica* as among "...the most powerful human influences on salt marshes in Europe", and that introductions there and other places in the world are often questionable (Ranwell, 1972). *Spartina* hybrids have been used in many locations including the Netherlands and North Carolina to reclaim tidelands. Some hybrids have shown very aggressive and adaptive traits, and have been difficult to eradicate once introduced. Introduction of *Spartina* into Willapa Bay, Washington, resulted in a rapid expansion of the species across the tideflats and into oyster-raising areas. Once this expansion takes place, a favorable environment for expansion of the native species is created, and the natural marsh succession process is accelerated over a large area.

There is some indication that the introduction of *Spartina* may be considered to stabilize dredge spoils in the Columbia River, and there is always the possibility that a curious individual might plant a colony in any given estuary, as has happened in Washington State. Although the nature of Oregon estuaries (in that fresh water influences are dominant during marsh germination) may be such that *Spartina* could not survive here, the subject deserves research. The Oregon coastal experience with introduced upland plants is such that local residents probably realize the implications of a similar process in our limited estuary areas.

DESCRIPTION OF INDIVIDUAL WETLAND AREAS

The following section contains a description of the major estuary and inland wetland areas of the coastal zone. Maps are provided for most of the tidal marsh areas and the main areas of inland marsh. These maps are included only for purposes of illustrating discussions in the text. More detailed, larger scale maps of these wetlands are being used by OCC&DC in developing a coastal zone management program.

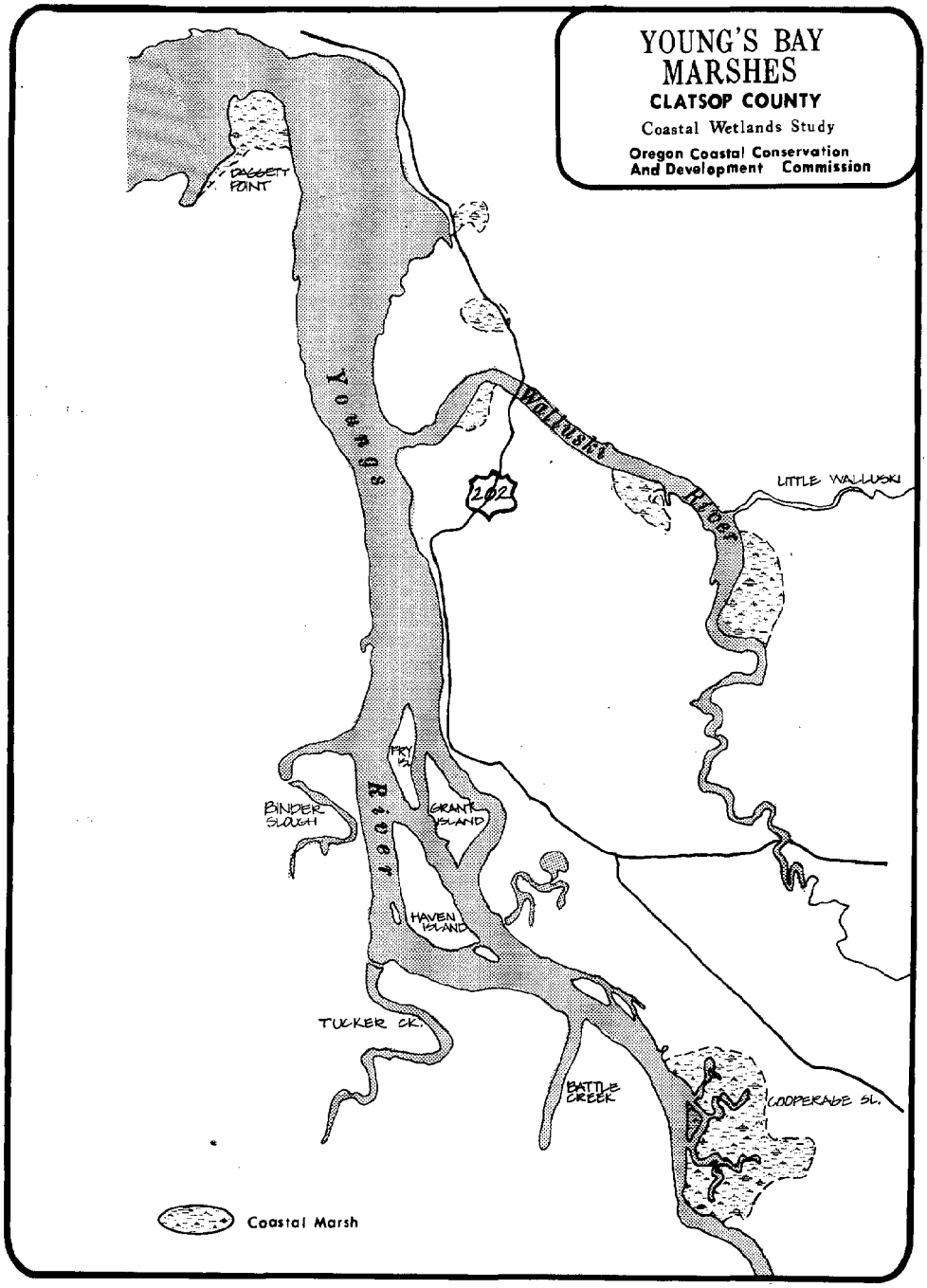
Although eelgrass areas are discussed in the following section, maps of these areas are not being printed, except for Coos Bay, which contains extensive areas of eelgrass. The Fish Commission of Oregon is currently releasing a series of reports on the fishery resources of Oregon estuaries which include maps of eelgrass beds. Discussion of these areas in this report is based on the large-scale eelgrass maps provided to OCC&DC by the Fish Commission.

Information on the location and extent of estuary areas in the following section is derived from the *Oregon Estuaries* (June, 1973) report of the Division of State Lands. Information regarding physical characteristics taken from *Descriptions and Information Sources for Oregon's Estuaries*, a March, 1973 report of the Water Resources Research Institute at Oregon State University. Descriptions of the Fish and Wildlife resources of estuary areas is derived from field reports of Oregon Wildlife Commission biologists to Rolland F. Rousseau of the Wildlife Commission's headquarters staff, who provided them to OCC&DC. Description of estuary waters and tidelands is derived from the *Inventory of Filled Lands* completed in 1972 by the Division of State Lands. Descriptions of tidal marshes and inland wetlands is derived from field work and map and aerial photograph interpretation by the authors. Information on the original extent, modification and expansion of marshes is taken from the work of Dr. Carl L. Johannessen of the University of Oregon, as cited elsewhere in this report. Land and tidelands ownership information is taken from a variety of sources, including small scale land ownership maps developed by the Widllife Commission as part of the State-wide Fish and Wildlife Plan, and the tidelands ownership maps developed in 1972 and 1973 by the Division of State Lands.

Wetlands of the Columbia River - Youngs Bay Area

LOCATION AND EXTENT

The estuary wetlands of northern Clatsop County are in two locations. The major wetland area is the Lower Columbia



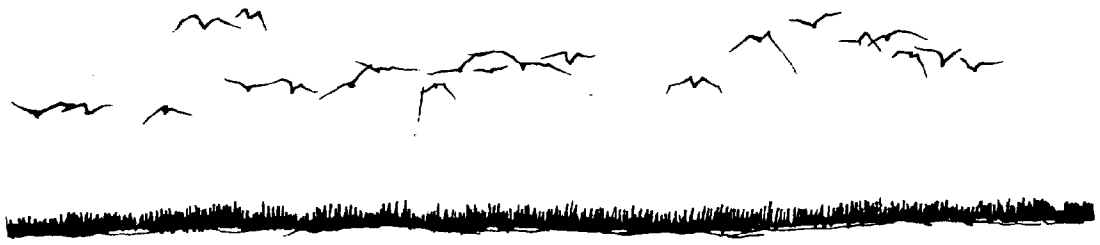
River marshes, extending from 5 miles above Astoria upstream 17 miles to Puget Island. The second area includes a number of small tidal marsh areas along the Youngs and Walluski Rivers south of Astoria. The Columbia River estuary covers 93,782 acres.

DESCRIPTION OF WETLAND AREAS

The Columbia River - Youngs Bay area contains a vast amount of shallow estuary waters of which approximately 23,000 acres are estimated to be of habitat value by the Oregon Wildlife Commission. The estuary also contains 24,500 acres of tidelands. Almost all of the 8,660 acres of the coastal salt marsh habitat type in Clatsop County is located in the Lower Columbia River marshes. These islands are in the surgeplain, and therefore contain some vegetation (such as *Phragmites*) which is characteristic of fresh water marshes.

COMMENTS

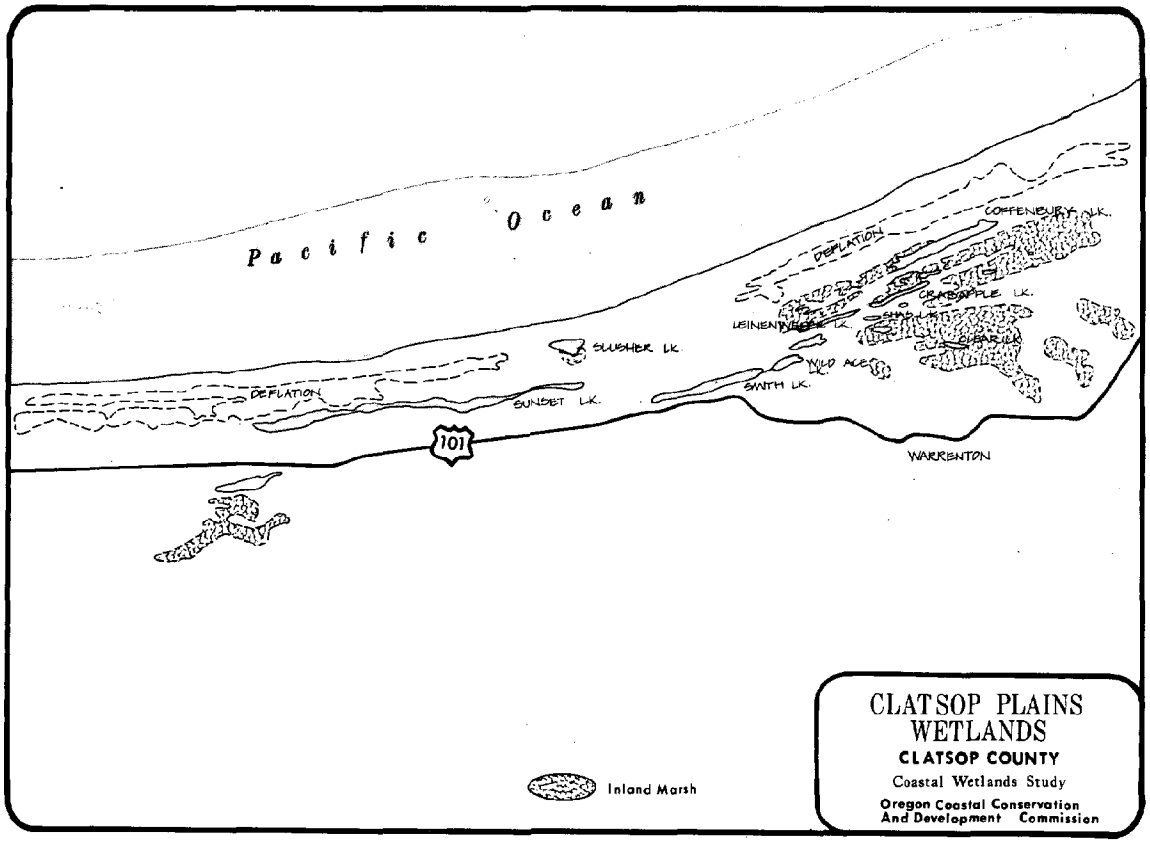
The smaller tracts of salt marsh along the Youngs and Walluski Rivers are primarily in private ownership. Eight thousand two hundred acres of the marsh islands of the Columbia River, which are the most significant wetlands in the coastal zone, are scheduled for purchase by the federal government, to establish a national wildlife refuge.



Clatsop Plains Wetlands

LOCATION AND EXTENT

The Clatsop Plains area is a broad expanse of sand extending from the Columbia River southward to the Seaside-Gearhart area. Most of the inland wetlands of this area occur between the primary dune and U.S. 101.



DESCRIPTION OF WETLAND AREAS

The Clatsop Plains contain the major inland wetland area of the coastal zone. As shown on the accompanying map, there are numerous long sinuous lakes filling low areas and depressions between the beach ridges, and inland from the edge of the sand mass. Besides these lakes, there are numerous areas of fringe marsh and riparian vegetation, bogs, and shrub swamps. The two major wetland types of this area, however, are the inland marsh and the dunes marsh.

The inland marsh areas are very numerous, occurring along and between the variety of lakes. Two large inland marsh expanses occur south of Coffenbury Lake and around Clear Lake in the Warrenton area.

Extensive areas of deflation plain occur immediately inland from the primary dunes throughout the Clatsop Plains. Over the past several decades extensive stabilization activities have been undertaken in this area, providing an environment for the establishment of deflation plain marshes. These areas are of great value for wintering waterfowl and other wildlife. As was previously discussed, however, these areas rapidly succeed to shrub swamps and upland vegetation types.

The Oregon Wildlife Commission estimates there are approximately 4,600 acres of inland marsh in this area. Of this, probably 1,500 acres are inland marsh, wetted all year, with the remainder being marsh areas in the deflation plains.

LAND OWNERSHIP

Most of the wetland areas of the Clatsop Plains are in public ownership either federal, state or county. Much of the deflation plain areas between Gearhart and Sunset Lake are in private ownership.

Wetlands of the Necanicum River

LOCATION AND EXTENT

The Necanicum River enters the Pacific Ocean between the cities of Seaside and Gearhart in Clatsop County, approximately 16 miles south of the Columbia River. The estuary covers 278 acres.

PHYSICAL CHARACTERISTICS

The Necanicum River and its principal tributaries, the Neawanna River and Neacoxie Creek, drain an area of approximately 78 square miles. Sedimentation is active in the river, as evidenced by past migrations of the mouth of the bay.

FISH AND WILDLIFE

The Oregon Wildlife Commission estimates 1,620 Coho Salmon, 2,000 Steelhead Trout, and 5,000 Cutthroat Trout pass through the bay on spawning runs. Other fish in the bay include herring, sculpins, perch and flounder.

DESCRIPTION OF WETLAND AREAS

The Necanicum estuary contains approximately 200 acres of shallow water and 149 acres of tidelands. The only remaining tidal marsh includes a small 20-acre area of immature high marsh on the Gearhart side of the Neawanna Channel, and a small 10-acre area of mature high marsh along the Necanicum River east of the sewage treatment plant. Both sides of the lower Necanicum exhibit fringe marshes of sedge. Most of the upper river is riprapped.

Tidal Fringe Marsh

LAND OWNERSHIP

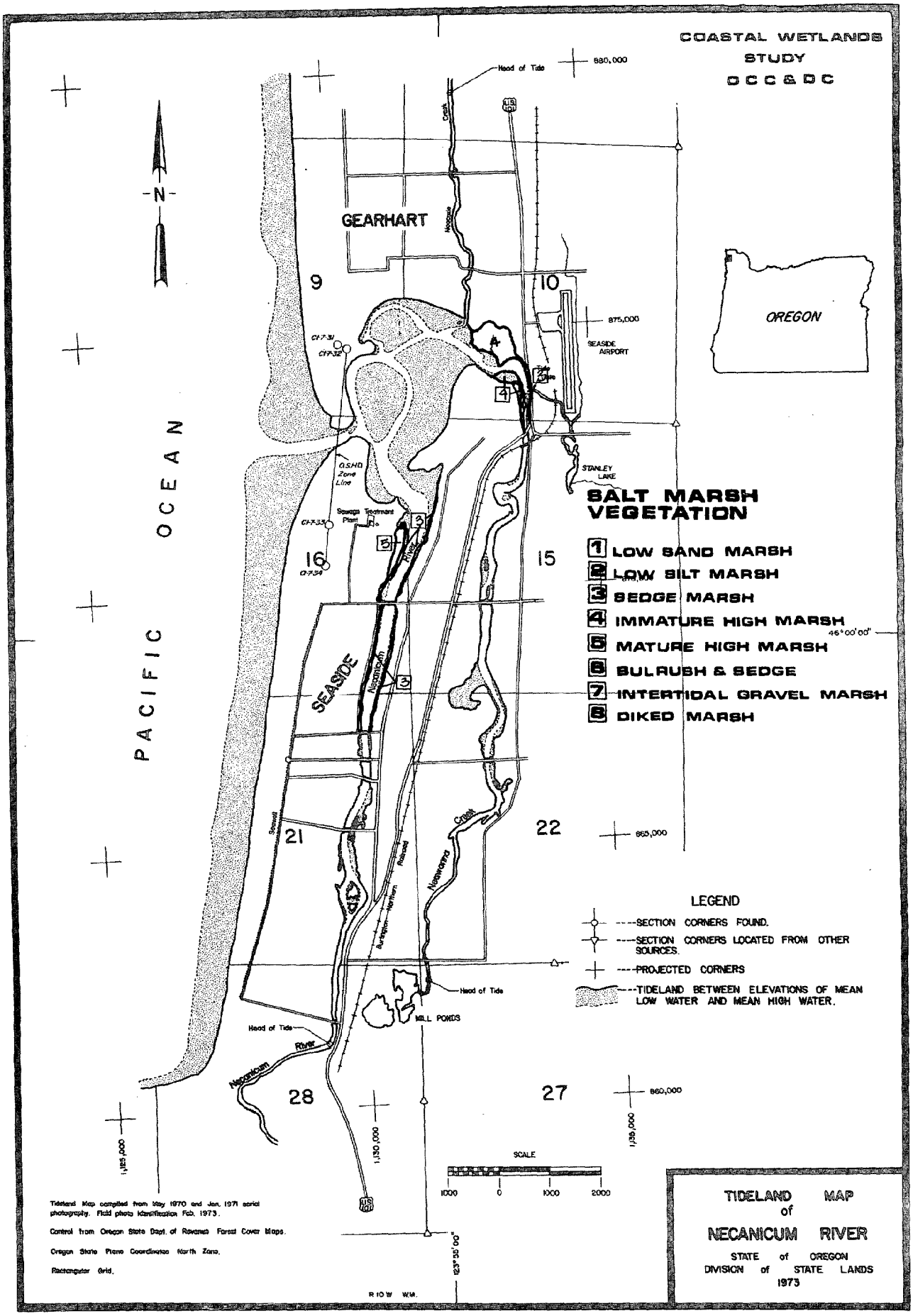
Private.

TIDELANDS OWNERSHIP

Most of the lower bay is in state or local government ownership. Tidelands in the upper bay are in private ownership.

LAND USE AND USE CONFLICTS

Almost all of the area surrounding Necanicum Bay is urbanized. Therefore, the major conflicts are domestic sewage and other flows entering the bay from urbanized areas, and development on lands subjected to tidal influence.


COASTAL WETLANDS
STUDY
OCC&DC
GEARHART
SEASIDE
PACIFIC OCEAN
SEASIDE AIRPORT
STANLEY LAKE
Sewage Treatment Plant
MILL PONDS
Head of Tide
OREGON
SALT MARSH VEGETATION
1 LOW SAND MARSH
2 LOW SILT MARSH
3 SEDGE MARSH
4 IMMATURE HIGH MARSH
5 MATURE HIGH MARSH
6 BULRUSH & SEDGE
7 INTERTIDAL GRAVEL MARSH
8 DIKED MARSH
LEGEND
---SECTION CORNERS FOUND.
---SECTION CORNERS LOCATED FROM OTHER SOURCES.
---PROJECTED CORNERS
---TIDELAND BETWEEN ELEVATIONS OF MEAN LOW WATER AND MEAN HIGH WATER.
SCALE
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865,000
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1,135,000
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46°00'00"
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R 10 W W.M.
Tideland Map compiled from May 1970 and Jan. 1971 aerial photography. Field photo identification Feb. 1973.
Control from Oregon State Dept. of Revenue Forest Cover Maps.
Oregon State Plane Coordinates North Zone.
Rectangular Grid.
TIDELAND MAP
of
NECANICUM RIVER
STATE of OREGON
DIVISION of STATE LANDS
1973

Wetlands of the Nehalem Bay

LOCATION AND EXTENT

The Nehalem estuary is located in northern Tillamook County, 40 miles south of the Columbia River. The estuary is 2,309 surface acres in extent at mean high tide.

PHYSICAL CHARACTERISTICS

The Nehalem River drains a watershed area of approximately 847 square miles, 91% of which is heavily forested. Part of the watershed was damaged by an episode of the Tillamook Burn in 1933. One-hundred, sixteen-thousand tons of sediments ranging from sand to clay are deposited in the estuary annually.

Sedimentation in Nehalem Bay has resulted in a major expansion of the marshes onto the mudflats. Johannessen (1961) estimated that the margin of the marsh expanded 1200 feet across the bay between 1875 and 1939 at a rate of 18 feet per year, and that since 1939, the rate has increased to 27 feet per year.

FISH AND WILDLIFE

The Nehalem River is estimated to have an anadromous spawning population of:

(1) 4,000 Fall Chinook Salmon;

(2) 21,840 Coho Salmon;

(3) 200 Chum Salmon;

(4) 11,000 Winter Steelhead;

(5) 8,000 Sea-run Cutthroat.

Fish and shellfish regularly taken from the estuary include perch, sculpin, crabs and softshelled clams.

The bay has a large population of waterfowl during the fall and winter, including Black brant during March and April. Salt pans on the northeast edge of the estuary are particularly important as watering areas for approximately one thousand band-tailed pigeons. Oregon Wildlife Commission data

indicates the estuary supports the Whistling Swan, 6 species of geese, 24 species of ducks, 22 shorebird species, and 47 other species of aquatic birds. The Oregon Wildlife Commission estimated 1970 hunter-use of the area as 1,875 hunter days for waterfowl, and 900 hunter days for Band-tailed pigeon. Marine mammals using the estuary include the hair and fur seals and the sea lion.

DESCRIPTION OF WETLAND AREAS

Considerable shallow water areas are located north of the main river channel between Fishery Point and Wheeler, and east of the channel between Fishery Point and Brighton. In these areas occur much of the bay's 1,078 acres of tidelands. Two large beds of eelgrass occur on these tideflats, one south of Fishery Point along the east bank of the river, and another along the main channel at the north-central margin of the estuary.

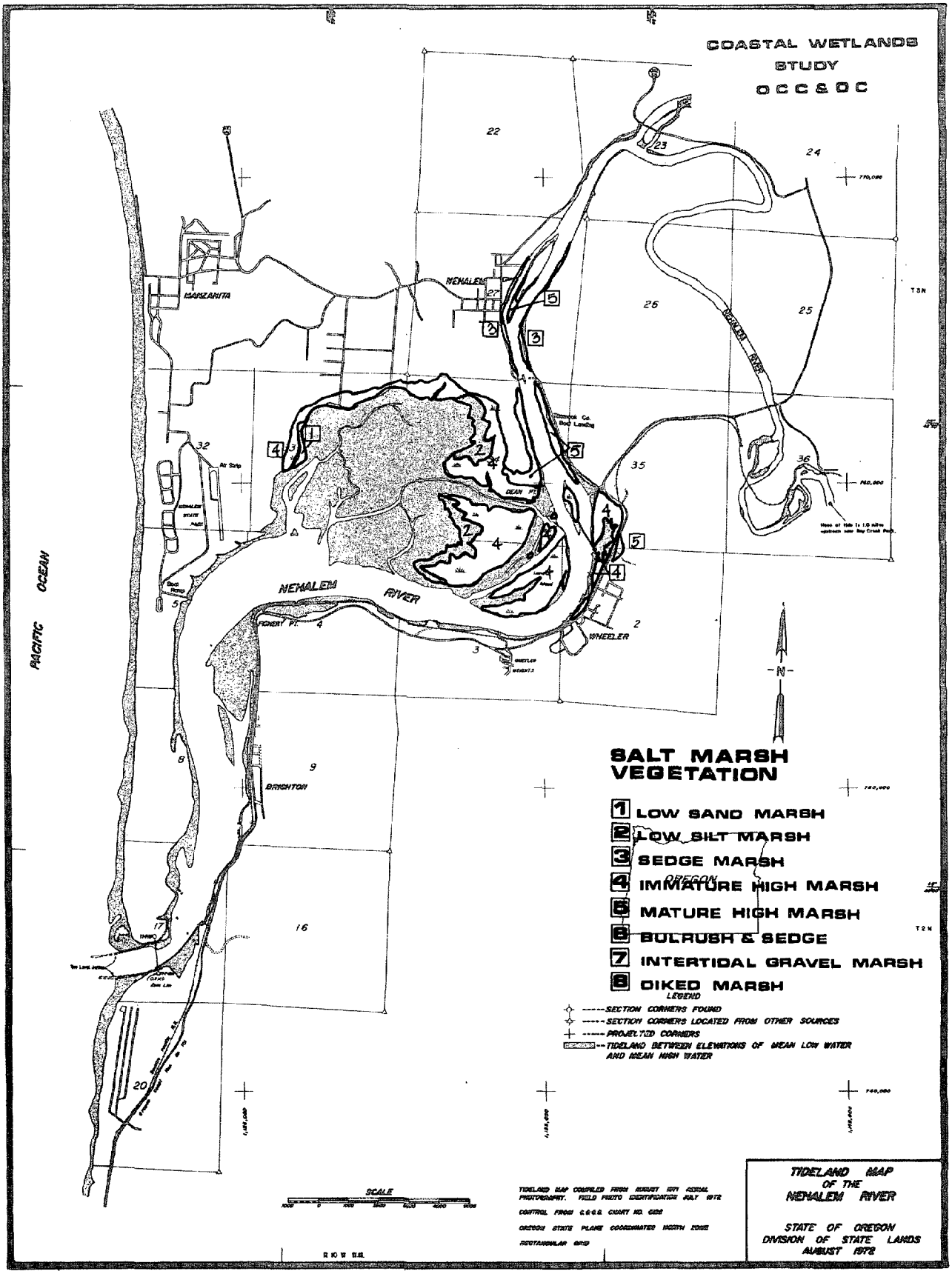
Most of the marshes of Nehalem Bay occur in the large embayment extending northwest of Wheeler and south and west of Dean Point, a high wooded ridge separating the embayment from the river channel. As shown on the accompanying map, the estuary contains extensive areas of immature high marsh, outward from which two major areas of low silt marsh are expanding. Areas of mature high marsh are found along both sides of the river south of the Highway 101 bridge, and along the south and southwest margins of Dean Point. A small acreage of low sand marsh is found along the west margin of the large embayment. Fringe marshes of sedge extend northward from the U.S. 101 bridge along both sides of the river.

LAND OWNERSHIP

Much of the margins of Nehalem Bay are in public ownership. The west margin of the lower estuary and the embayment, and the immature high marsh islands south and west of Dean Point are in state and county ownership. Dean Point and the fringe of mature high marshes to the south and east are privately owned, as are the mature and immature high marshes and sedge marshes along the east margins of the estuary between Wheeler and Nehalem.

TIDELAND OWNERSHIP

The majority of the tidelands in the large embayment are in public ownership. The west margin of the embayment near Nehalem State Park is in state ownership. The tidelands on the south and east sides of Dean Point and those along the


COASTAL WETLANDS
STUDY
OCC&DC
PACIFIC OCEAN
NEHALEM RIVER
MANZANITA
BRIGHTON
WHEELER
SALT MARSH VEGETATION
1 LOW SAND MARSH
2 LOW SILT MARSH
3 SEDGE MARSH
4 IMMATURE HIGH MARSH
5 MATURE HIGH MARSH
6 BULRUSH & SEDGE
7 INTERTIDAL GRAVEL MARSH
8 DIKED MARSH
LEGEND
SECTION CORNERS FOUND
SECTION CORNERS LOCATED FROM OTHER SOURCES
PROJECTED CORNERS
TIDELAND BETWEEN ELEVATIONS OF MEAN LOW WATER AND MEAN HIGH WATER
SCALE
TIDELAND MAP OF THE NEHALEM RIVER
STATE OF OREGON
DIVISION OF STATE LANDS
AUGUST 1972

east margin of the estuary are in private ownership, with the exception of the inlet near Wheeler and the areas just north and south of the Tillamook County boat landing, which are in public ownership.

LAND USE AND USE CONFLICTS

The estuary watershed is used extensively for logging, dairy farming and cattle production. The immediate area of the wetlands is used for urban and recreational activities. Existing and potential impacts of land use on wetland resources as estimated by the Oregon Wildlife Commission include:

Existing Impacts

(1) untreated sewage from local communities;

(2) siltation from gravel removal;

(3) siltation and debris from logging in the estuary watershed;

(4) dredging and filling for residential development;

Anticipated Impacts

(1) wildlife harassment from increased recreational boating traffic;

(2) construction of new U.S. 101 highway bridge; and

(3) additional gravel dredging.

Wetlands of Tillamook Bay

LOCATION AND EXTENT

Tillamook Bay, third largest estuary in Oregon, is located in central Tillamook County 50 miles south of the Columbia River. The size of the estuary is 8,289 acres at mean high tide.

PHYSICAL CHARACTERISTICS

Tillamook Bay receives the waters of five major rivers --the Miami, Kilchis, Tillamook, Trask and Wilson--which drain a watershed of 574 square miles. Precipitation ranges from 150 inches in the upper watershed to 90 inches annually along the coast. The rivers empty an estimated 135,000 tons of sediment annually into the estuary.

Because of extensive sedimentation following the Tillamook Burn in 1933 the estuary is considered to be 40% its original size. Rapid expansion of tidal marsh has occurred in the delta areas of the Kilchis and Wilson Rivers, because of the resultant buildup of the tideflats. Johannessen estimates a marsh expansion rate of 14 feet per year from 1867 to 1939, and nine feet per year from 1939 to 1969. Since European settlement the marsh has expanded approximately one third of a mile outward onto the tideflats. Diking of tidal marsh landward from the deltas for dairying has reclaimed extensive areas over the past century. Over 2,700 acres of the Tillamook plain have been included in five drainage districts (Johannessen, 1961).

FISH AND WILDLIFE

Tillamook Bay and its five major rivers provide spawning habitat for a large number of trout and salmon which are of special recreational significance to many sportsmen in the northern Willamette Valley, as well as elsewhere. These spawning populations include:

(1) 6,120 Spring Chinook Salmon;

(2) 33,705 Fall Chinook Salmon;

(3) 33,625 Coho Salmon;

(4) 9,900 Chum Salmon;

(5) 49,575 Winter Steelhead;

(6) 2,400 Summer Steelhead; and

(7) 18,000 Sea-run Cutthroat Trout.

This estuary is important for the commercial raising of oysters, as about 80% of Oregon's oyster production comes from Tillamook Bay tidelands. The significance of Tillamook Bay for waterfowl was severely reduced in 1952, when the Bayocean Peninsula broke through and buried extensive areas of eelgrass. These beds are now being re-established and provide habitat for Black brant and numerous ducks. The bay supports seven species of swans and geese, 24 species of ducks, 23 shorebird species, and 24 other species of water-associated birds.

DESCRIPTION OF WETLAND AREAS

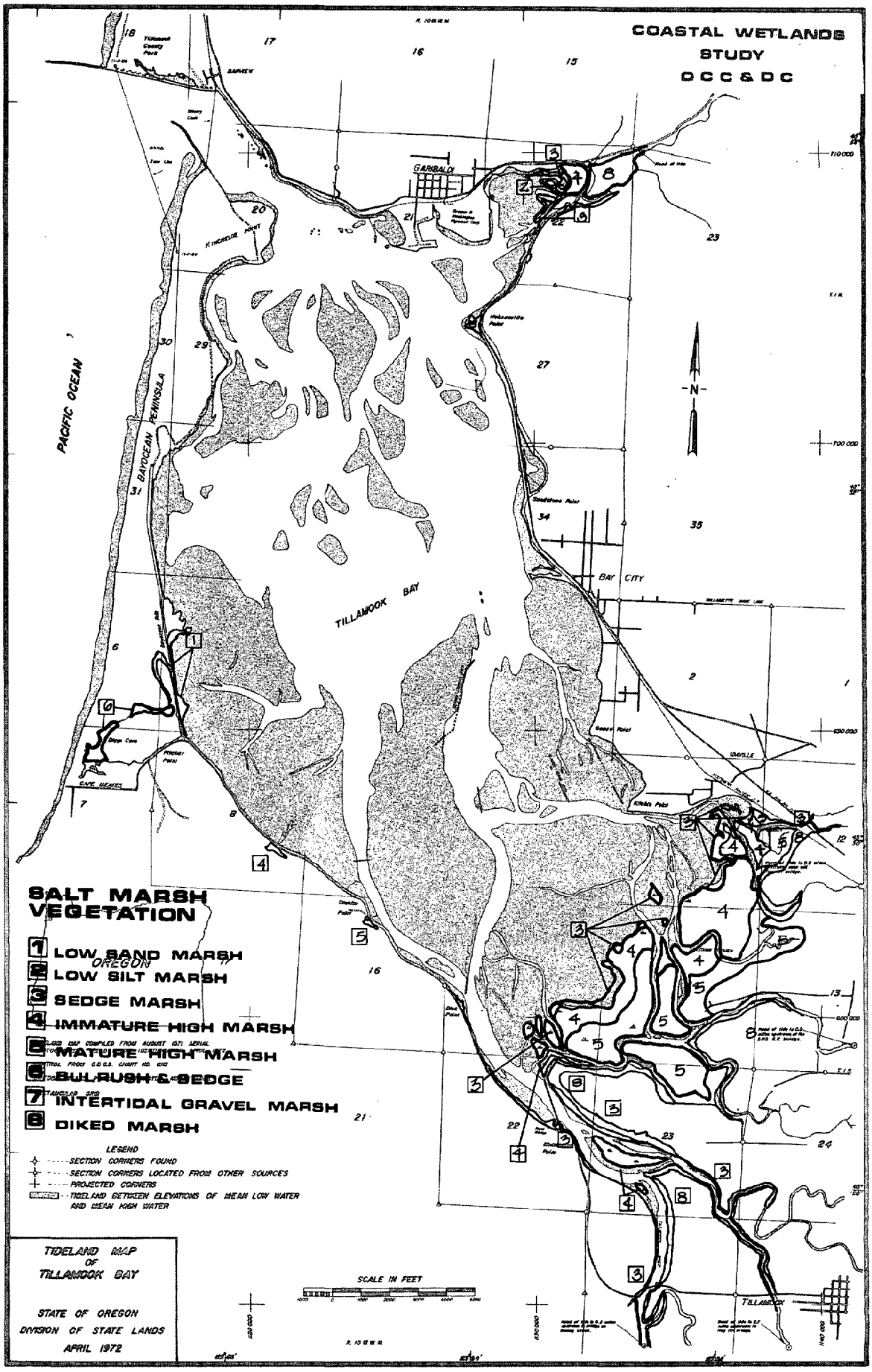
Because of extensive siltation, Tillamook Bay contains an extensive amount of shallow water. There are 4,163 acres of tidelands, on which numerous large eelgrass beds occur.

There are three spearate areas of tidal marsh in Tillamook Bay. The main concentration of marsh is in the delta area of the Wilson and Kilchis Rivers, which extends over a square mile. The area contains primarily mature and immature high marshes, with some sedge islands occurring in the fresher areas at the mouths of the rivers. An area of low silt marsh is expanding outward onto the tideflats in the area between the channels of the Wilson River. An island of immature high marsh of approximately 20 acres occurs in the delta area of the confluence of the Trask and Tillamook Rivers. A fringe marsh of sedge extends along the west margin of the Tillamook River.

The second marsh area, consisting of immature high marsh fringed with sedge marsh and low silt marsh, is located at the delta of the Miami River. Upriver diking has reduced the size of this marsh by half.

The third marsh area is the diked Biggs Cove area, a former salt marsh which is being revegetated with a bullrush-sedge community because of fresh water influence within the dikes. Areas outside the dikes are characterized by low sand salt marsh vegetation.

Extensive fringe marshes of sedge are found on both sides of the Miami, Wilson, Trask and Tillamook Rivers, extending landward well into the diked pasturelands.


COASTAL WETLANDS
STUDY
OCC&DC
PACIFIC OCEAN
BAYOCEAN PENINSULA
TILLAMOOK BAY
BAY CITY
GARIBALDI
TILLAMOOK
OREGON
SALT MARSH VEGETATION
1 LOW SAND MARSH
2 LOW SILT MARSH
3 SEDGE MARSH
4 IMMATURE HIGH MARSH
5 MATURE HIGH MARSH
6 BULRUSH & SEDGE
7 INTERTIDAL GRAVEL MARSH
8 DIKED MARSH
LEGEND
SECTION CORNERS FOUND
SECTION CORNERS LOCATED FROM OTHER SOURCES
PROJECTED CORNERS
TIDELAND BETWEEN ELEVATIONS OF MEAN LOW WATER AND MEAN HIGH WATER
TIDELAND MAP OF TILLAMOOK BAY
STATE OF OREGON
DIVISION OF STATE LANDS
APRIL 1972
SCALE IN FEET
N
R. 10 W. W. M.

LAND OWNERSHIP

With few exceptions, the marshes of Tillamook Bay are privately owned.

TIDELAND OWNERSHIP

Tideland ownership in Tillamook Bay is fragmented. The tidelands of the Wilson River delta is in state and private ownership. The Miami River delta area is in private ownership.

LAND USE AND USE IMPACTS

The major land uses in the watershed are forestry and cattle production. Dairying is a major use of the Tillamook plain area. Thirty-nine manufacturers, primarily dealing in wood products and fish processing, are located in the communities around the estuary. Commercial oyster production takes place in the south end of the bay.

The Oregon Wildlife Commission estimates the use conflicts with local resources to include:

(1) gravel dredging in the Miami, Kilchis, Wilson and Trask Rivers, which produces siltation affecting eelgrass and other waterfowl feeding areas;

(2) log rafting and log storage on wetlands in Miami Cove;

(3) potential channel dredging to facilitate navigation;

(4) potential expansion of marina facilities in areas used for wildlife;

(5) potential landfilling for waterfront development; and

(6) potential harassment of waterfowl from increased recreational boating traffic.

Wetlands of Netarts Bay

LOCATION AND EXTENT

Netarts Bay is located in central Tillamook County, about 7 miles west of the City of Tillamook. The bay covers 2,325 acres.

PHYSICAL CHARACTERISTICS

Netarts Bay is influenced primarily by the tides, as the bay watershed covers 14 square miles and yields only 42,000 acre-feet of fresh water per year. Little sedimentation occurs as well, averaging 2,250 tons per year.

FISH AND WILDLIFE

This area is primarily a shellfish bay, with minor sport fishing. The Oregon Wildlife Commission indicates winter steelhead, coho salmon and sea-run cutthroat are present in the small tributaries with some perch, flounder and rockfish occurring in the bay itself.

The bay is an important area for migratory waterfowl, especially Black brant, which depend on the eelgrass of the estuary, and require more freedom from harrassment than other waterfowl. The bay provides habitat for the Whistling Swan, 5 species of geese, 24 species of ducks, 23 species of shorebirds, and 25 other species of aquatic birds. There are an estimated 180,000 waterfowl-use days on the bay during the wintering season.

DESCRIPTION OF WETLANDS

Netarts Bay is significant primarily for large areas of shallow waters, tidelands and eelgrass. The bay contains 1,513 acres of tidelands, and the Oregon Fish Commission has mapped 5 large eelgrass beds in the bay, occurring along the east shore of the upper bay and in the center.

The bay contains only 164 acres of tidal marsh, occurring in two major sections. The entire length of the sandspit is fringed on the bay side with narrow bands of low sand marsh and immature high marsh. The lower end of the bay is marked by a 100-acre mature high marsh, in the area of Cape Lookout State Park. Some minor areas of sedge marsh and mature high marsh occur along the east margin of the bay.

LAND OWNERSHIP

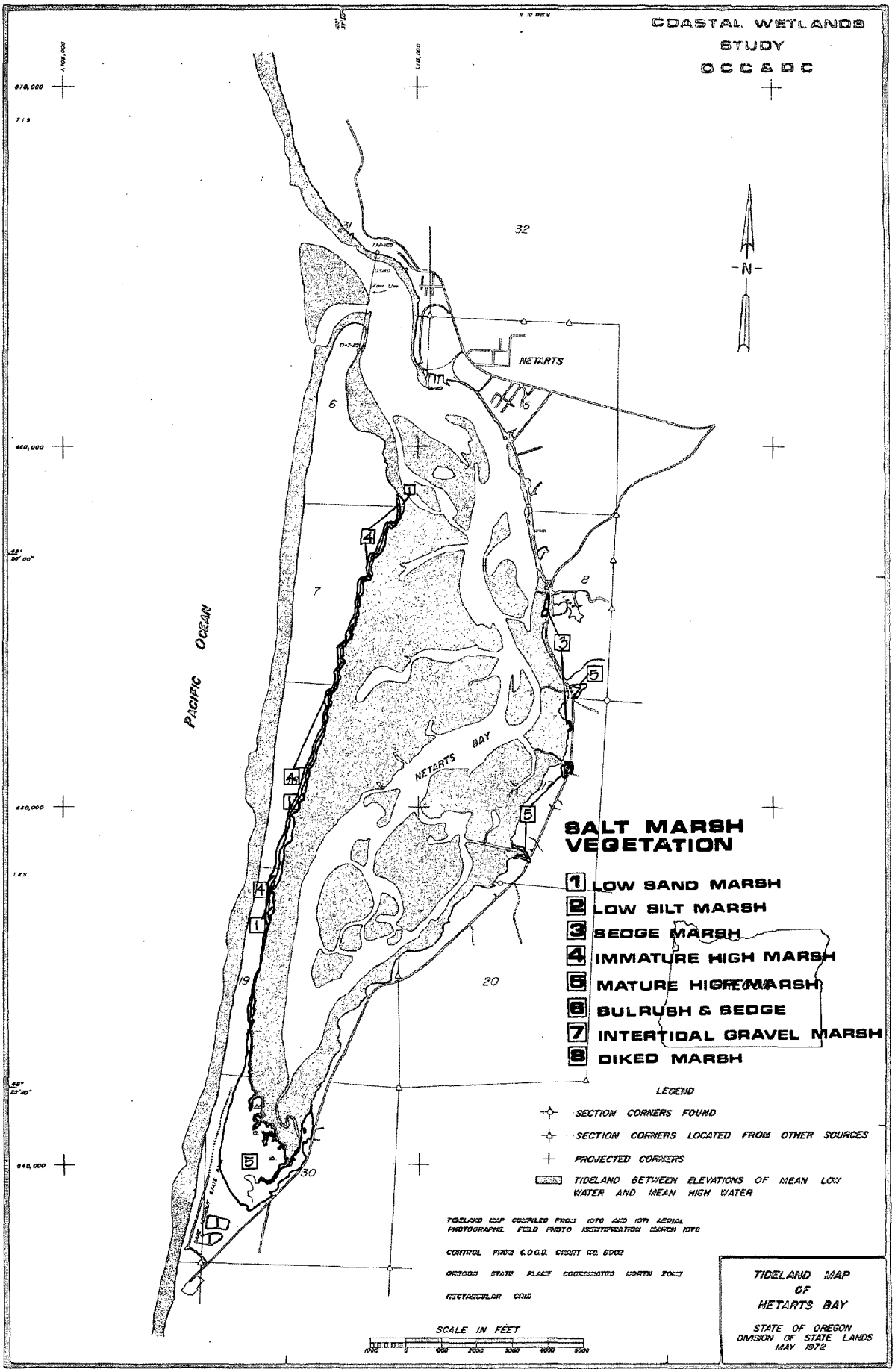
The entire west margin of the bay is in State (Park) ownership. The immediate shorelands on the east side of the bay (west of Highway 617) are in small private ownership. The uplands above the east side of the bay (east of Highway 617) are primarily in corporation (timber) ownership.

TIDELAND OWNERSHIP

Except for two areas totaling about 120 acres on the east-central margin of the bay, all tidelands are in State ownership.

LAND USE AND USE CONFLICTS

The Oregon Wildlife Commission indicates the primary problem in the past has been domestic sewage (from septic tanks) entering the bay. A proposal to discharge treated domestic sewage from a municipal treatment plant into the bay is currently being studied by the U.S. Environmental Protection Agency.


COASTAL WETLANDS
STUDY
OCC&DC
PACIFIC OCEAN
NETARTS BAY
NETARTS
SALT MARSH VEGETATION
1 LOW SAND MARSH
2 LOW SILT MARSH
3 SEDGE MARSH
4 IMMATURE HIGH MARSH
5 MATURE HIGH MARSH
6 BULRUSH & SEDGE
7 INTERTIDAL GRAVEL MARSH
8 DIKED MARSH
LEGEND
SECTION CORNERS FOUND
SECTION CORNERS LOCATED FROM OTHER SOURCES
PROJECTED CORNERS
TIDELAND BETWEEN ELEVATIONS OF MEAN LOW WATER AND MEAN HIGH WATER
TIDELAND MAP OF NETARTS BAY
STATE OF OREGON DIVISION OF STATE LANDS MAY 1972
SCALE IN FEET

Wetlands of the Sand Lake Bay

LOCATION AND EXTENT

The Sand Lake Estuary is located in southern Tillamook County, about 15 miles southwest of the City of Tillamook. The estuary covers 528 acres, although the total wetland area is much larger.

PHYSICAL CHARACTERISTICS

The tributaries of the Sand Lake estuary drain an area approximately 17 square miles. Sedimentation averages approximately 2,500 tons per year. The estuary is one of three in the coastal zone with a sandy rather than silty bottom, or substrate.

DESCRIPTION OF WETLANDS

Sand Lake contains a large area of shallow water, 397 acres of tidelands, and three distinct eelgrass beds. The estuary contains one of the most diverse tidal marsh areas in the coastal zone. There are extensive areas of five marsh types totaling approximately 702 acres. Active expansion of marsh onto the tideflats is occurring between the numerous islands (most of which are covered with immature high marsh) and the east margin of the estuary (which contains large areas of mature high marsh). The northern area of the estuary is fringed with sedge marsh, while the southern portion is fringed primarily with low sand marsh.

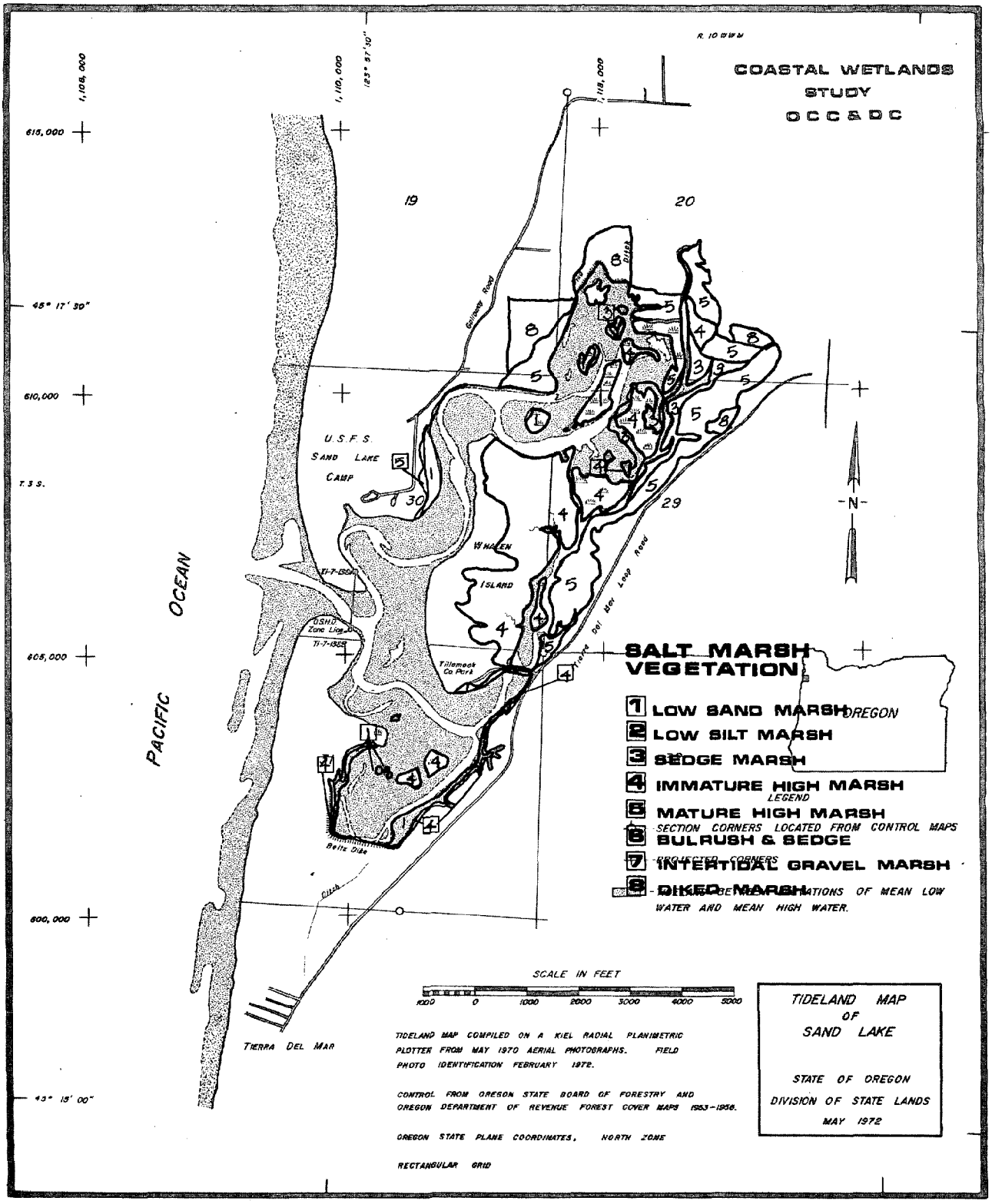
Extensive diking for pastureland has occurred on both the northern and southern margins of the estuary. The Beltz Dike has resulted in a recent reduction of the salt marsh in the area north of the community of Tierra del Mar.

LAND OWNERSHIP

The Sand Lake area is characterized by large areas of small private, corporate, county, and federal ownership. Most of the marsh areas are in individual private holdings.

TIDELAND OWNERSHIP

Except for one tract immediately north of the Beltz Dike, all of the tidelands of the estuary are in State ownership.


COASTAL WETLANDS
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OCC&DC
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615,000
45° 17' 30"
610,000
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19
20
29
30
PACIFIC OCEAN
U.S.F.S.
SAND LAKE
CAMP
WHALEN
ISLAND
Galloway Road
Tillamook Co Park
Belts Dike
Ditch
TIERRA DEL MAR
SALT MARSH
VEGETATION
1 LOW SAND MARSH
2 LOW SILT MARSH
3 SEDGE MARSH
4 IMMATURE HIGH MARSH
5 MATURE HIGH MARSH
6 BULRUSH & SEDGE
7 INTERTIDAL GRAVEL MARSH
8 DIKED MARSH
LEGEND
SECTION CORNERS LOCATED FROM CONTROL MAPS
PROJECTED CORNERS
OREGON
N
SCALE IN FEET
1000 0 1000 2000 3000 4000 5000
TIDELAND MAP COMPILED ON A KIEL RADIAL PLANIMETRIC PLOTTER FROM MAY 1970 AERIAL PHOTOGRAPHS. FIELD PHOTO IDENTIFICATION FEBRUARY 1972.
CONTROL FROM OREGON STATE BOARD OF FORESTRY AND OREGON DEPARTMENT OF REVENUE FOREST COVER MAPS 1953-1956.
OREGON STATE PLANE COORDINATES, NORTH ZONE
RECTANGULAR GRID
TIDELAND MAP
OF
SAND LAKE
STATE OF OREGON
DIVISION OF STATE LANDS
MAY 1972

LAND USE AND USE CONFLICTS

Past modifications of the marsh areas have resulted from agricultural uses. The margins of the estuary have experienced pressure from residential uses, particularly mobile homes, and recreational use of the sand areas to the northwest of the estuary has increased in recent years. To date, however, few modifications have resulted from other than agricultural activities.

Wetlands of the Nestucca Bay

LOCATION AND EXTENT

Nestucca Bay is located in southern Tillamook County near Pacific City, Oregon. The estuary is approximately 1,000 acres in size at mean high tide.

PHYSICAL DESCRIPTION

The estuary receives drainage from a 322 square mile watershed which is mostly forested. The Nestucca and Little Nestucca deposit about 54,000 tons of sediment annually ranging from sands to clay. Sedimentation and flooding resulting from constriction of the estuary mouth by shifting dunes are considered major problems.

Nestucca Bay

FISH AND WILDLIFE

The Nestucca River system and estuary is an important spawning ground for anadromous fish, including:

(1) 1,890 Spring Chinook Salmon;

(2) 20,565 Fall Chinook Salmon;

(3) 18,580 Coho Salmon;

(4) 2,000 Chum Salmon;

(5) 37,290 Winter Steelhead Trout;

(6) 5,600 Summer Steelhead Trout; and

(7) 5,800 Sea-run Cutthroat Trout

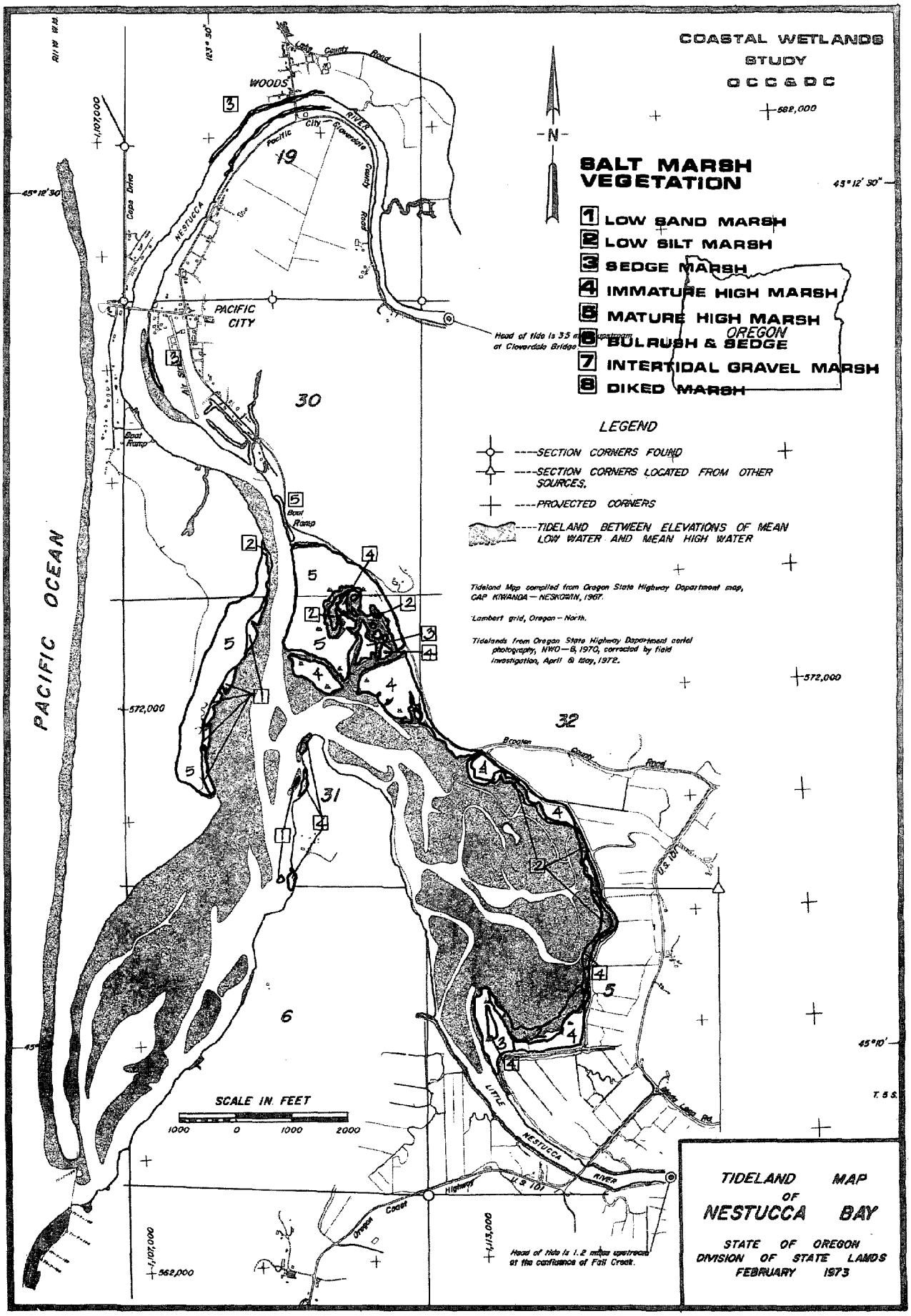
The Bay is a significant migration and wintering area for waterfowl, with an estimated 69,000 waterfowl-use days occurring between October and April. Habitat is provided for 26 species of ducks, 7 species of geese, 23 shorebird species, and 25 other species of gulls, terns, cormorants, herons, grebes and loons.

Nestucca Bay also contains saline flats which are used for watering by Band-tailed pigeons.

DESCRIPTION OF WETLANDS

Wetlands are located primarily in the two large embayments of the estuary, as shown on the accompanying map. Of the 1,000 acres of the estuary, 578 acres are tidelands. Oregon Fish Commission data indicated three large eelgrass beds in Nestucca Bay, two in the Little Nestucca embayment and one in the main embayment.

The marshes of the Nestucca estuary, although not extensive, are extremely diverse. There are approximately 222 acres of tidal marsh in the estuary. The marsh system is centralized in the area of confluence of the Little Nestucca River embayment and the Nestucca River embayment. Within an area of approximately 100 acres, there are two large tracts of immature high marsh surrounded by an expanse of mature high marsh, several sedge marsh islands, all with margins of low silt marsh filling the intervening areas shown as channels on the Division of State Lands Tidelands Map. An expanse of mature high marsh of approximately 50 acres occurs on the west margin of the estuary. The entire east margin of the Little Nestucca


COASTAL WETLANDS
STUDY
OCC&DC
SALT MARSH VEGETATION
1 LOW SAND MARSH
2 LOW SILT MARSH
3 SEDGE MARSH
4 IMMATURE HIGH MARSH
5 MATURE HIGH MARSH
6 BULRUSH & SEDGE
7 INTERTIDAL GRAVEL MARSH
8 DIKED MARSH
OREGON
LEGEND
----SECTION CORNERS FOUND
----SECTION CORNERS LOCATED FROM OTHER SOURCES.
----PROJECTED CORNERS
----TIDELAND BETWEEN ELEVATIONS OF MEAN LOW WATER AND MEAN HIGH WATER
Tideland Map compiled from Oregon State Highway Department map, CAP. KWANDA — NESKOWIN, 1967.
Lambert grid, Oregon — North.
Tidelands from Oregon State Highway Department aerial photography, NWO—8, 1970, corrected by field investigation, April & May, 1972.
Head of tide is 3.5 miles upstream at Clowerdale Bridge
Head of tide is 1.2 miles upstream at the confluence of Fall Creek.
PACIFIC OCEAN
PACIFIC CITY
WOODS
NESTUCCA RIVER
Cape Kiwanda
Pacific City - Cloverdale County Road
Brooten County Road
Little Nestucca River Rd.
Boat Ramp
Highway
Oregon Coast
U.S. 101
SCALE IN FEET
1000 0 1000 2000
572,000
562,000
45°12' 30"
45°10'
T. 5 S.
TIDELAND MAP OF NESTUCCA BAY
STATE OF OREGON
DIVISION OF STATE LANDS
FEBRUARY 1973

embayment is fringed with immature high marsh (with numerous areas of low silt marsh expanding outward) backed up to an extensive dike running from Brooten Road to the south end of the embayment. At the south end is located approximately 18 acres of immature high marsh and low silt marsh, and a 15-acre delta area of immature high marsh fringed with sedges. Fringe marshes of sedge also occur along the margins of the Nestucca channel near Woods and Pacific City.

LAND OWNERSHIP

With the exception of the mature high marsh area on the east margin of North Spit (which is state-owned) the marshes of the Nestucca Estuary are privately owned.

TIDELANDS OWNERSHIP

Nearly all of the tidelands of Nestucca Bay are in state ownership. The only major exception is a small tract of private ownership of a few acres in the center of the large marsh south of the Pacific City boat ramp.

LAND USE

Most of the estuary watershed is used for forestry, with the floodplain areas being used for pasture. Six firms in the estuary area are involved in manufacturing, primarily timber handling and fish processing. Some grazing takes place, usually on the mature high marsh areas.

EXISTING AND ANTICIPATED USE IMPACTS

No significant fills have occurred in the estuary. The Oregon Wildlife Commission considers disturbance of North Spit (which might result in sand deposition into the estuary) as the only apparent potential use conflict.

Wetlands of the Salmon River Bay

LOCATION AND EXTENT

The Salmon River enters the Pacific Ocean 85 miles south of the Columbia River, on the border of Tillamook and Lincoln Counties. The estuary covers about 204 acres.

PHYSICAL CHARACTERISTICS

The total watershed of the Salmon River is about 78 square miles. The river rises in a wetland area, the Jeeter Prairie - Lost Prairie - Elk Wallow vicinity approximately 12 miles east of Rose Lodge. Approximately 14,000 tons of sediments enter the estuary annually.

FISH AND WILDLIFE

The Oregon Wildlife Commission estimates the spawning population of anadromous fish is:

(1) 2,040 Fall Chinook Salmon;

(2) 180 Spring Chinook Salmon;

(3) 5,730 Coho Salmon;

(4) 4,180 Steelhead; and

(5) 3,770 Cutthroat Trout.

It is noted in a recent Oregon State University publication (Percy, 1973) that these totals are low for an estuary of this size.

Additionally, there are approximately 18,000 waterfowl-use days on the estuary during the wintering season. The estuary is an important habitat area for the Whistling Swan, five species of geese, 26 species of ducks, 23 shorebirds, and 25 other species of aquatic birds.

*A detailed study of this area entitled *Cascade Head-Salmon River Land Use and Ownership Plan* was completed by the U.S. Forest Service in June of 1972.

DESCRIPTION OF WETLAND AREAS

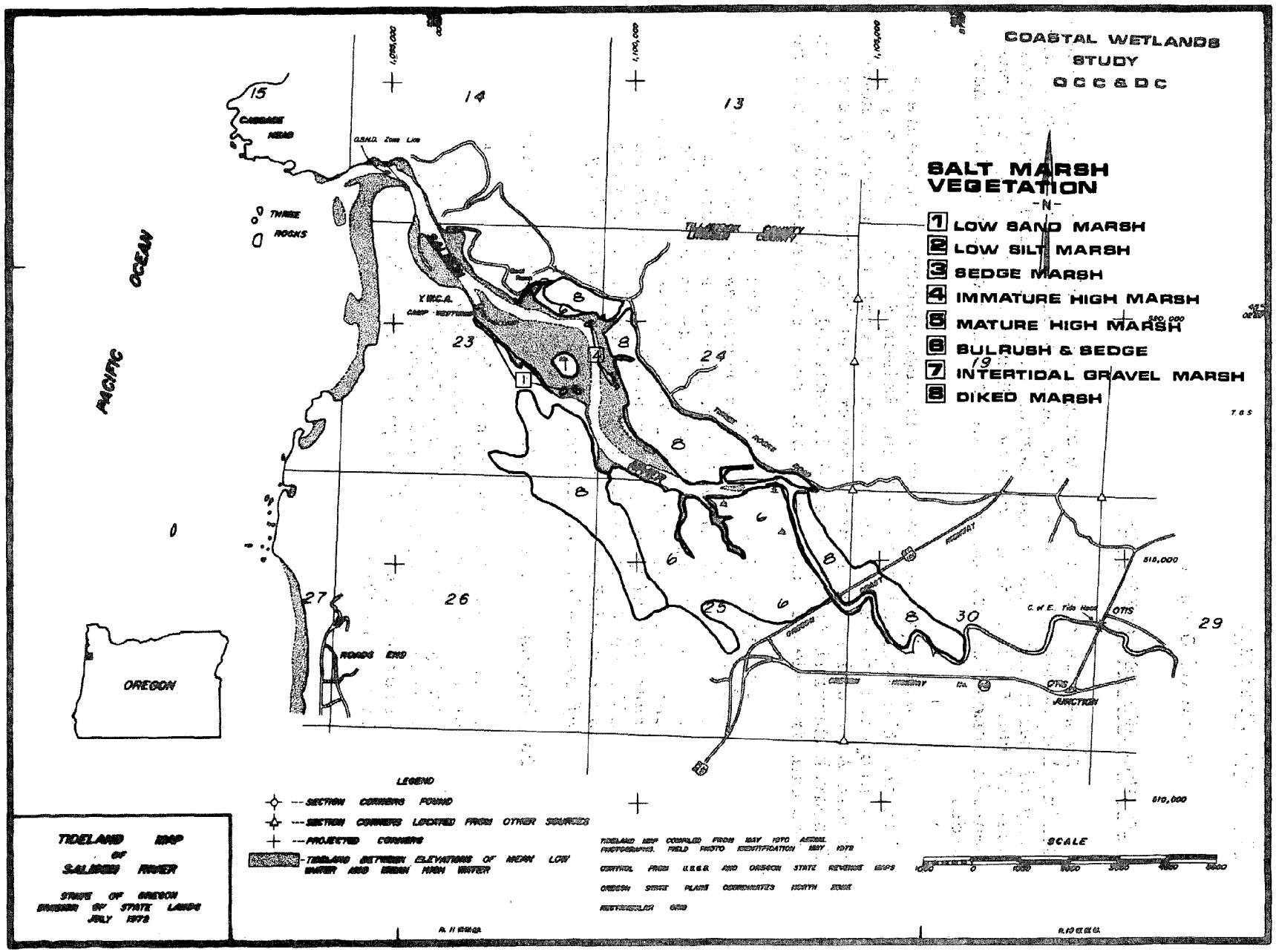
The Salmon River estuary contains less than 200 acres of shallow waters, and 126 acres of tidelands. The Oregon Fish Commission has mapped two major areas of eelgrass in the estuary, one extending from the mouth of the estuary upstream about one mile, and another occurring about one mile downstream from the U.S. 101 highway bridge.

There are approximately 552 acres of tidal marsh, approximately half of which is mature high marsh, with the remainder being diked marsh. There is one small area (approximately five acres) of low sand marsh in the lower part of the estuary.

LAND OWNERSHIP

Private.

Salmon River Wetlands
(Pixieland in Lower Right)


COASTAL WETLANDS
STUDY
OCC&DC
SALT MARSH
VEGETATION
-N-
1 LOW SAND MARSH
2 LOW SILT MARSH
3 SEDGE MARSH
4 IMMATURE HIGH MARSH
5 MATURE HIGH MARSH
6 BULRUSH & SEDGE
7 INTERTIDAL GRAVEL MARSH
8 DIKED MARSH
PACIFIC OCEAN
CAPE MEARES
THREE ROCKS
Y.M.C.A.
CAMP MEEHAN
TILLAMOOK COUNTY
ROADS END
OTIS
OTIS JUNCTION
OREGON
SCALE
LEGEND
TIDELAND MAP
OF
SALMON RIVER
STATE OF OREGON
DIVISION OF STATE LANDS
JULY 1972

TIDELAND OWNERSHIP

State of Oregon.

LAND USE AND USE CONFLICTS

As may be seen on the accompanying picture and map, much diking has occurred in the past in this area. Grazing and cutting of marsh hay (see right center of photo) are traditional uses of the Salmon River estuary. Recently, filling for residential homesites has occurred in the area despite flood hazards.

The U.S. Forest Service has recommended a management plan for the wetland areas of the Salmon River area, as part of a proposal to associate the estuary with the Cascade Head Scenic Area and Experimental Forest, and the Neskowin Crest Research Natural Area, located immediately to the north. This proposal includes a recommendation that the wetlands should be:

> *...managed to protect and perpetuate the fish and wildlife, scenic, and research-educational values, while allowing dispersed recreation in the form of sport fishing, non-motorized pleasure boating, and waterfowl hunting. Agriculture (grazing or forage production) could be allowed to continue at least until such time as a decision is reached on the feasibility of breaching the dikes.*

The proposal also includes the observation that:

> *...the possibility exists that at some point in the future the area could become commercially or industrially developed. For this reason, the estuary and associated wetlands deserves and requires protection through public ownership.*

Wetlands of Siletz Bay

LOCATION AND EXTENT

Siletz Bay is located in northern Lincoln County, immediately south of Lincoln City. The estuary covers 1,187 acres.

PHYSICAL CHARACTERISTICS

Siletz Bay receives drainage from a 364 square mile watershed, much of which has been logged. Seventy-four thousand tons of sediments enter the estuary annually. Heavy siltation has occurred in the past.

FISH AND WILDLIFE

The Oregon Wildlife Commission estimates the spawning population of the Siletz estuary to include:

(1) 24,500 Coho Salmon;

(2) 13,600 Fall Chinook Salmon;

(3) 7,700 Winter Steelhead Trout;

(4) 4,900 Summer Steelhead Trout; and

(5) 21,300 Cutthroat Trout.

Other bay fish include herring, perch, starry flounder, tomcod and shad.

Siletz Bay provides habitat for the Whistling Swan, 5 species of geese, 26 species of ducks, 23 shorebirds and 25 other species of aquatic birds. An estimated 85,000 waterfowl-use days occur on Siletz Bay during the wintering season.

DESCRIPTION OF WETLANDS

Siletz Bay includes a considerable area of shallow water, partly because of the extensive siltation of recent years. The bay has 775 acres of tidelands. Oregon Fish Commission maps indicate only three small eelgrass beds in the estuary, two of which are immediately adjacent to the mouth. The extent and location of these beds are probably indicative of the sedimentation problems in the estuary.

The bay contains 322 acres of tidal marsh, most of which has been fragmented by development. A large 90 acre tract of mature high marsh occurs between Millport Slough and the main channel of the river. This area is nearly surrounded by dikes, roads and highways, spoils disposal areas and other fills. The new U.S. 101 bridge fill and the Siletz Keys development, (as well as the old U.S. 101 bridge) has separated the mature high marsh area from the sedge marsh islands further out on the tideflats. North of the main channel in the embayment near Cutler City, several immature and mature high marsh islands occur. The east and north margins of the estuary are fringed with low silt marsh, while the bay side of the Salishan Sandspit is fringed with low sand marsh. The east side of The Lagoon on the Salishan Sandspit is fringed with mature high marsh. Extensive diked areas (approximately 90 to 100 acres) occur along both sides of the river above Kernville.

LAND OWNERSHIP

All of the immediate Siletz Bay area is privately owned. Most is in small individual holdings, except for two or three areas of corporate ownership.

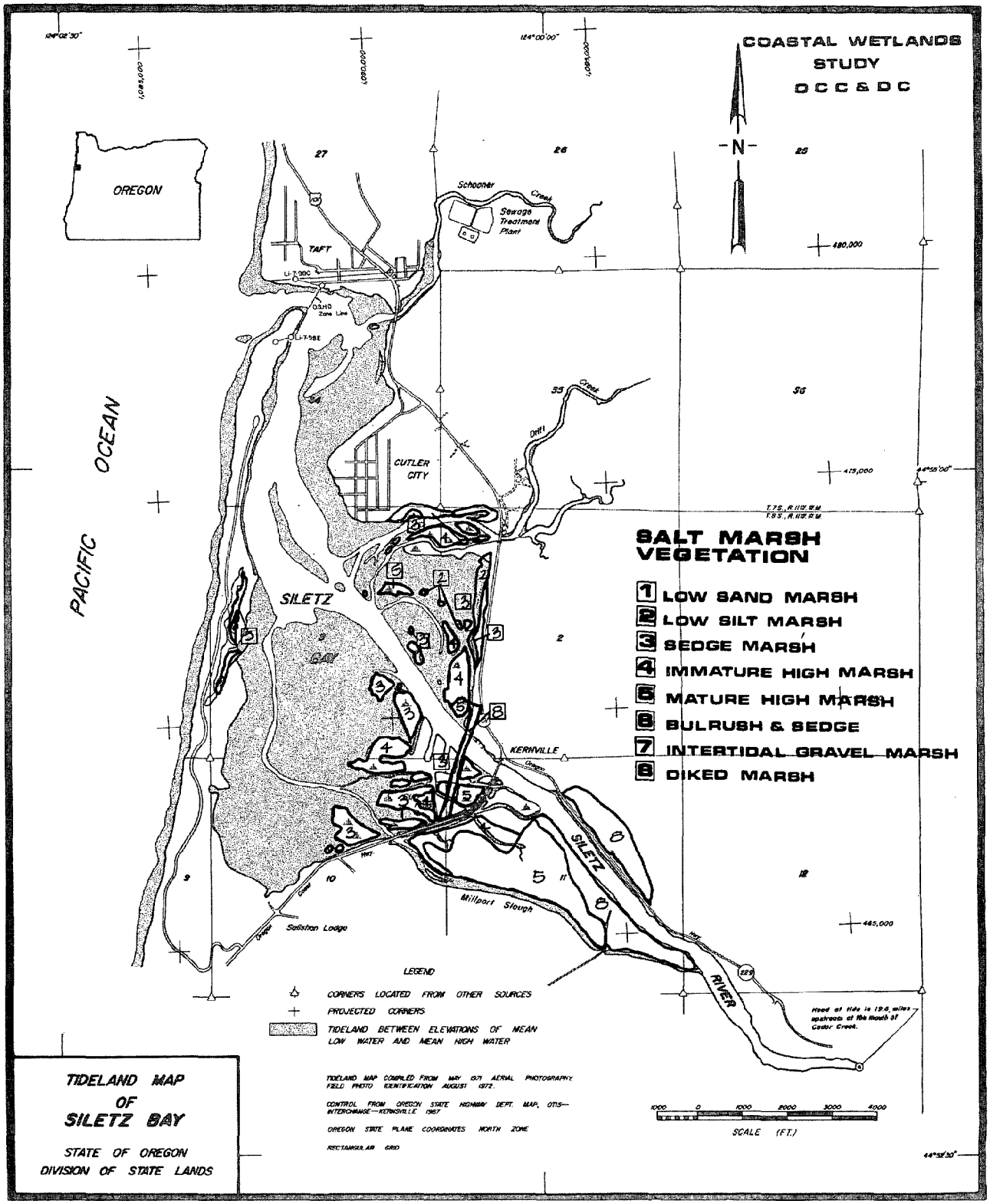
TIDELAND OWNERSHIP

The State of Oregon owns all the tidelands of Siletz Bay.

LAND USE AND USE CONFLICTS

The major conflicts of uses with resource functions and values in Siletz Bay are direct--sedimentation from the watershed, and fills in the estuary. Future conflicts may develop from additional recreational development, including small boat basins and related marine commercial facilities.

Some of the marsh areas of the estuary are included in the "Marshland" category of the Siletz Bay Land and Water Use Plan, and are therefore, designated as "Natural Resource" areas in the Lincoln County zoning ordinance (included in the MANAGEMENT section of this report).


COASTAL WETLANDS STUDY
D C C & D C
N
OREGON
PACIFIC OCEAN
Schooner Creek
Sewage Treatment Plant
TAFT
CUTLER CITY
SILETZ BAY
KERHVILLE
Millport Slough
Siletz River
Salishan Lodge
480,000
475,000
465,000
SALT MARSH VEGETATION
1 LOW SAND MARSH
2 LOW SILT MARSH
3 SEDGE MARSH
4 IMMATURE HIGH MARSH
5 MATURE HIGH MARSH
6 BULRUSH & SEDGE
7 INTERTIDAL GRAVEL MARSH
8 DIKED MARSH
LEGEND
CORNERS LOCATED FROM OTHER SOURCES
PROJECTED CORNERS
TIDELAND BETWEEN ELEVATIONS OF MEAN LOW WATER AND MEAN HIGH WATER
SCALE (FT.)
TIDELAND MAP OF SILETZ BAY
STATE OF OREGON
DIVISION OF STATE LANDS

Wetlands of Yaquina Bay*

LOCATION AND EXTENT

Yaquina Bay is located in central Lincoln County, adjacent to the city of Newport. The estuary is the fourth largest in the coastal zone, covering 3,910 acres.

PHYSICAL CHARACTERISTICS

The Yaquina Bay watershed covers 389 square miles. Sedimentation averages 30,000 tons per year.

FISH AND WILDLIFE

Yaquina Bay is one of the most popular sport fishing centers in the coastal zone. The Oregon Wildlife Commission estimates the following spawning population of game fish in the estuary area:

(1) 12,600 Coho Salmon;

(2) 2,100 Fall Chinook Salmon;

(3) 2,300 Steelhead Trout; and

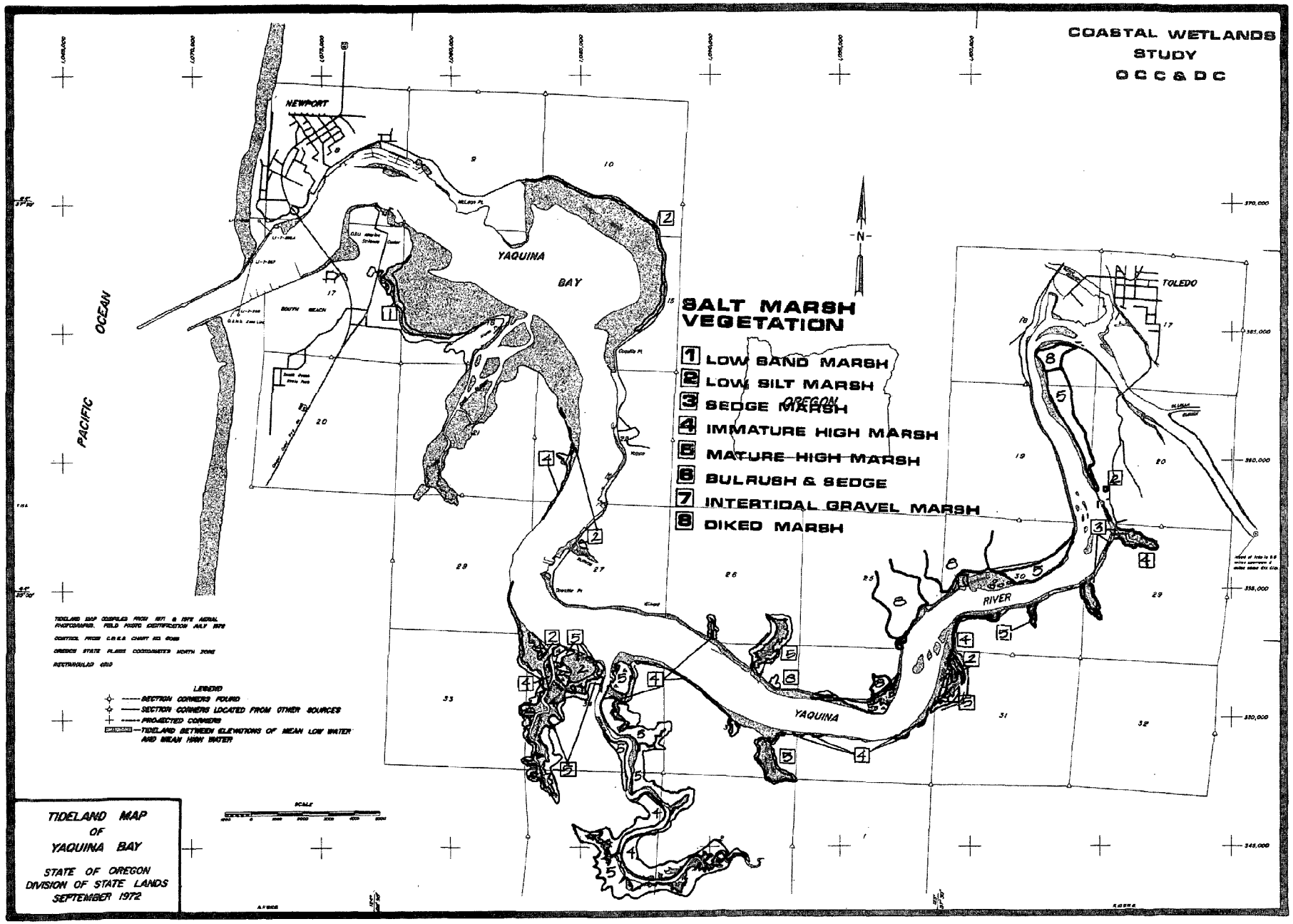
(4) 7,500 Cutthroat Trout.

The U.S. Fish and Wildlife Service estimates 180 species of birds use the Yaquina estuary. The upper bay is important for wintering waterfowl, with a peak of 30,000 waterfowl use-days occurring. Two Band-tailed pigeon areas are located in the upper bay near Toledo.

DESCRIPTION OF WETLANDS

Yaquina Bay contains extensive areas of shallow water in the large embayments of the lower estuary, and in the sloughs of the upper estuary. There are also 1,353 acres of tidelands in the bay. The estuary is notable for the large eelgrass beds which occur in the lower and middle portions of the bay.

* A resource inventory entitled *Fish and Wildlife of Yaquina Bay, Oregon*, was completed by the U.S. Fish and Wildlife Service in 1968.


COASTAL WETLANDS
STUDY
OCC & DC
NEWPORT
YAQUINA
BAY
OCEAN
PACIFIC
TOLEDO
YAQUINA
RIVER
OREGON
N
SALT MARSH
VEGETATION
1 LOW SAND MARSH
2 LOW SILT MARSH
3 SEDGE MARSH
4 IMMATURE HIGH MARSH
5 MATURE HIGH MARSH
6 BULRUSH & SEDGE
7 INTERTIDAL GRAVEL MARSH
8 DIKED MARSH
LEGEND
SECTION CORNERS FOUND
SECTION CORNERS LOCATED FROM OTHER SOURCES
PROJECTED CORNERS
TIDELAND BETWEEN ELEVATIONS OF MEAN LOW WATER AND MEAN HIGH WATER
SCALE
TIDELAND MAP
OF
YAQUINA BAY
STATE OF OREGON
DIVISION OF STATE LANDS
SEPTEMBER 1972

Yaquina Bay contains 819 acres of tidal marsh. This total occurs in two major categories--low fringe marshes in the embayments of the lower estuary, and high marshes in the sloughs of the middle and upper estuary.

In the lower bay, Sally's Bend is fringed with low silt marsh, while the area between the Marine Science Center fill and Hinton Point is fringed with low sand marsh.

The major marsh area of Yaquina Bay is the mature and immature high marsh which extends the length of McCaffery and Pooles Slough. McCaffery Slough is primarily an area of immature high marsh fringed with mature high marsh. Pooles Slough is primarily mature high marsh. The delta between the two sloughs is an area of expanding low silt marsh. The sloughs of the upper bay are fringed with immature and mature high marsh and sedge marsh. An extensive area of diked marsh occurs along Boone's Slough.

LAND OWNERSHIP

All of the immediate uplands of Yaquina Bay (except the Marine Science Center fill) are in private ownership.

TIDELANDS OWNERSHIP

Other than the tidelands adjacent to the Marine Science Center, which are state-owned, most of the lower bay is in local government ownership. The middle and upper bay, including McCaffery and Poole's Slough, are in private ownership.

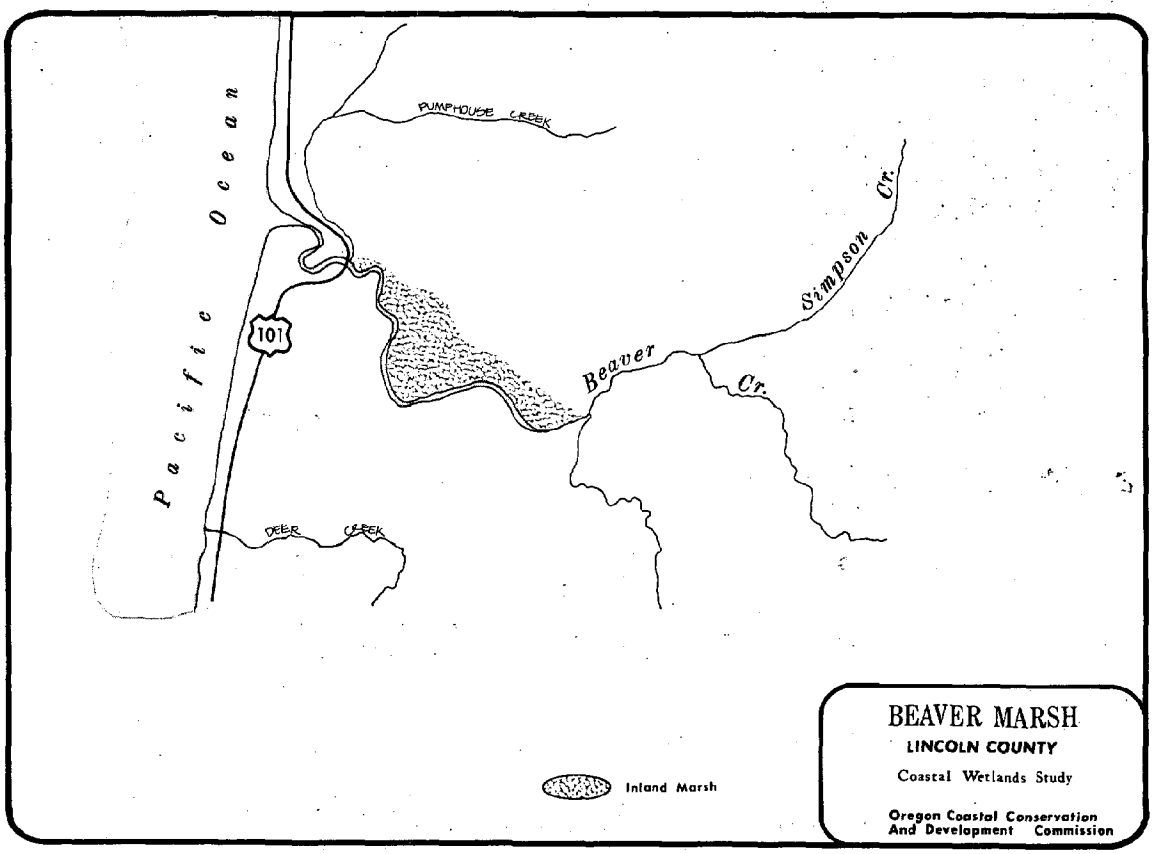
LAND USE AND USE CONFLICTS

Landfills in the estuary are the primary conflict in Yaquina Bay. Because of the location and importance of the bay as an educational, industrial and sport fishing center, demands on the estuary and adjacent uplands are intensive. Much of the wetland area is contained in the "Marshlands" and "Tidelands" categories of the Yaquina Bay Land and Water Use Plan, and therefore, is included within the "Natural Resource" designation of the Lincoln County Zoning Ordinance.

Beaver Creek Marsh

LOCATION AND EXTENT

Beaver Creek enters the Pacific Ocean about 7 miles south of Yaquina Bay. The marsh area covers approximately 80 acres.



DESCRIPTION OF WETLANDS

Tidal influence extends up Beaver Creek to the area just above the Highway 101 bridge. The damming effect of this tidal influence causes high fresh water flows in the creek to surge over the adjacent lowlands, thus bringing about a marsh environment primarily fresh water in character.

On the margins of the fresh marsh, areas of fresh water swamps merge with the edge of the spruce forest, providing a diversity of habitat types within a small area.

Upland Edge of the Beaver Creek Marsh

LAND OWNERSHIP

Private.

LAND USE AND USE CONFLICTS

This area is currently used for grazing and forage production, with no apparent conflicts to the value of the area for wildlife.

Wetlands of Alsea Bay

LOCATION AND EXTENT

The Alsea River enters the Pacific Ocean immediately west of the City of Waldport in southern Lincoln County. The estuary covers 2,146 acres.

PHYSICAL CHARACTERISTICS

The Alsea River drains an area of 474 square miles. Most of the watershed is heavily forested with regrowth from forest fires which occurred in 1847. Sedimentation is estimated at 249,000 tons annually.

FISH AND WILDLIFE

The Alsea watershed is one of the most important sport fishing areas of the coastal zone. The Oregon Wildlife Commission estimates the spawning population of the Alsea Bay system to include:

(1) 58,000 Coho Salmon;

(2) 20,000 Fall Chinook Salmon;

(3) 300 Spring Chinook Salmon;

(4) 7,640 Steelhead Trout; and

(5) 28,600 Cutthroat Trout.

Other bay fish include herring, starry flounder, sea perch and shad.

Alsea Bay provides habitat for wintering waterfowl, including the Whistling Swan, 3 species of geese, 25 species of ducks, 27 species of shorebirds, and 19 other species of aquatic birds. There is one Band-tailed pigeon watering area which is used by an estimated 1,000 birds, one of the heaviest concentrations in the coastal zone.

DESCRIPTION OF WETLANDS

Alsea Bay contains an extensive area of shallow water in the large embayment north of Waldport, and over 970 acres of tidelands. Four large eelgrass beds occur in the estuary,

one at the mouth and the other three along the north margin of the large embayment.

Alsea Bay contains 640 acres of tidal marsh, nearly all of which is mature high marsh. There is no other estuary in the coastal zone which contains so much undiversified marshland.

The major expanse of mature high marsh has occurred along the north shore of the estuary and on the marsh islands which have developed since barriers were placed in the north channel of the bay. Small areas of immature high marsh and low silt marsh occur along the margins of Lint, McKinneys and Eckman Slough. Areas of diked marsh occur along lower Drift Creek and between U.S. 34 and the upper estuary.

Johannessen (1961) states that little marsh expansion has occurred in the estuary. In fact, the southern and western shorelines of the marsh islands are retreating.

LAND OWNERSHIP

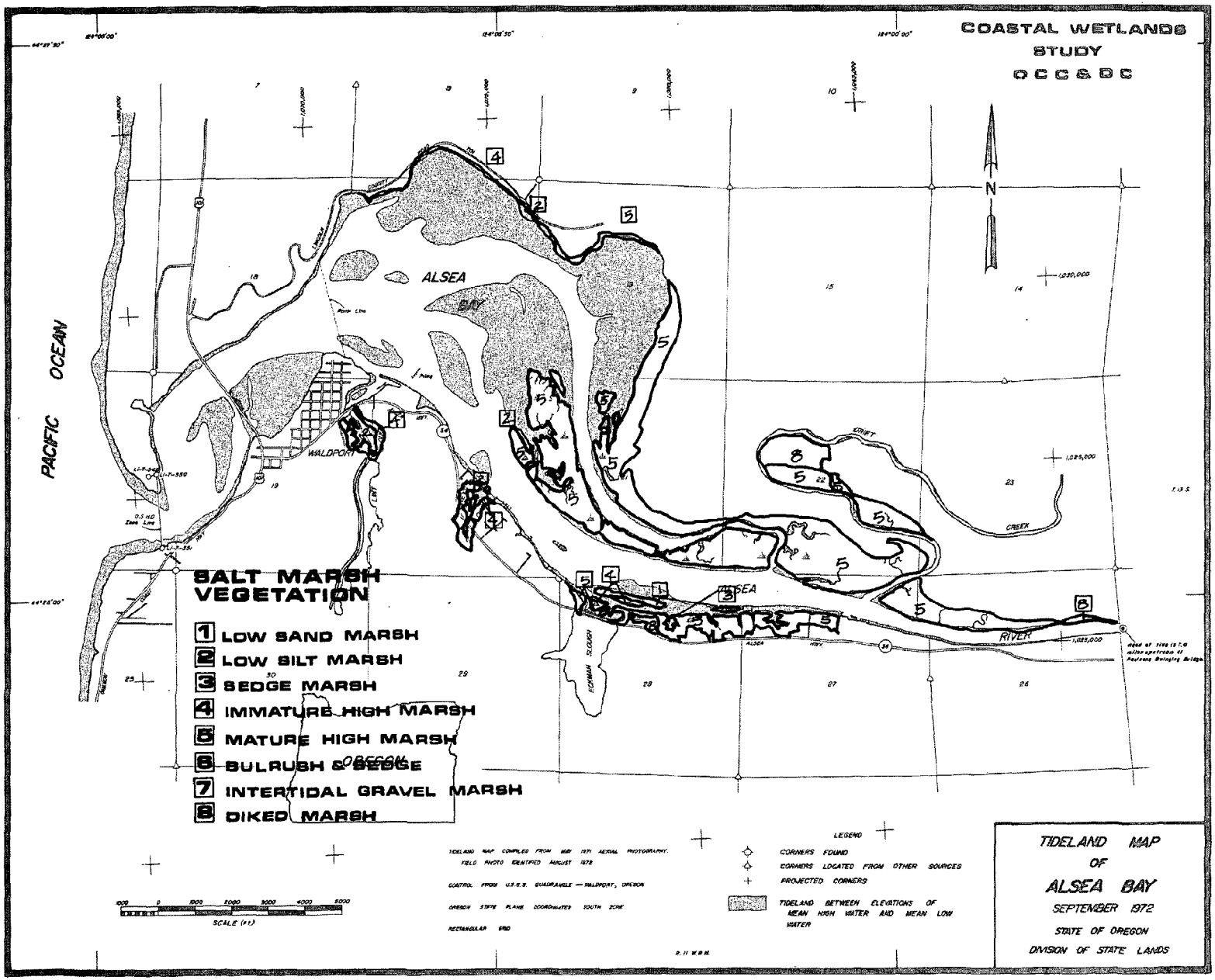
All of the uplands immediately adjacent to Alsea Bay are in private ownership, including small private corporate and timber holdings.

TIDELANDS OWNERSHIP

With a few exceptions of private ownership, all of the tidelands of Alsea Bay are in local government (port, county and city) ownership.

LAND USE AND USE CONFLICTS

Past conflicts have been primarily related to erosion and siltation. Future problems will probably involve pressure for filling the very extensive areas of mature high marsh in the north part of the estuary. Much of the mature high marsh areas are designated in the "Marshland" and "Tideland" categories of the Alsea Bay Land and Water Use Plan.


COASTAL WETLANDS
STUDY
OCC&DC
PACIFIC OCEAN
ALSEA
BAY
WALDPORT
ALSEA
RIVER
CREEK
SALT MARSH
VEGETATION
1 LOW SAND MARSH
2 LOW SILT MARSH
3 SEDGE MARSH
4 IMMATURE HIGH MARSH
5 MATURE HIGH MARSH
6 BULRUSH & SEDGE
7 INTERTIDAL GRAVEL MARSH
8 DIKED MARSH
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SCALE (FT.)
LEGEND
CORNERS FOUND
CORNERS LOCATED FROM OTHER SOURCES
PROJECTED CORNERS
TIDELAND BETWEEN ELEVATIONS OF MEAN HIGH WATER AND MEAN LOW WATER
TIDELAND MAP
OF
ALSEA BAY
SEPTEMBER 1972
STATE OF OREGON
DIVISION OF STATE LANDS

Wetlands of the Siuslaw Bay

LOCATION AND EXTENT

The Siuslaw River enters the Pacific Ocean about 3 miles northwest of the City of Florence, in western Lane County. The estuary covers 2,245 acres.

PHYSICAL CHARACTERISTICS

The Siuslaw drains a watershed of 773 square miles, and deposits an average of 103,000 tons of sediment in the estuary each year. Extensive sand deposition also results from wind action on the large dunes at the southern margin of the lower bay. The Siuslaw is one of three estuaries in the coastal zone with a sandy rather than silty substrate.

FISH AND WILDLIFE

Wild spawning populations of game fish in the Siuslaw estuary have been estimated by the Oregon Wildlife Commission as follows:

(1) 25,000 Coho Salmon;

(2) 4,500 Fall Chinook Salmon;

(3) 7,300 Steelhead Trout;

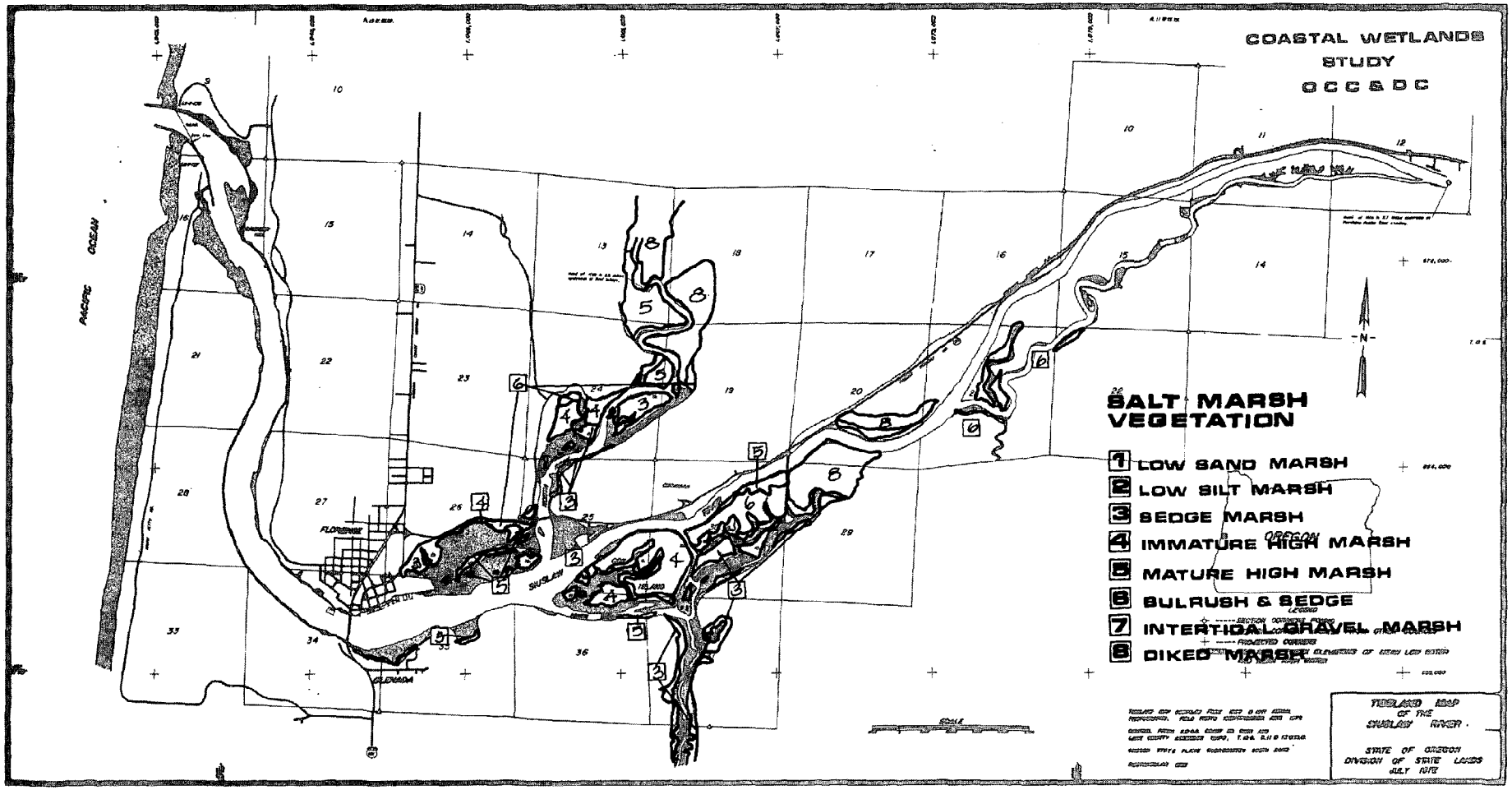
(4) 36,000 Cutthroat Trout;

(5) 1,000 Striped Bass; and

(6) 30,000 Shad.

The Siuslaw is considered the finest Cutthroat Trout estuary in the coastal zone. Other bay fish include herring and anchovies, ocean perch, sole, tomcod, lingcod, greenling and flounder.

A watering area for Band-tailed pigeons is located in the Duncan Inlet vicinity. A Bald Eagle has been observed in the bay in the summer of 1973, and apparently an active nest has been identified on the margin of the estuary.


COASTAL WETLANDS
STUDY
OCC&DC
PACIFIC OCEAN
FLORENCE
SIUSLAW
ISLAND
GLENADA
OREGON
SALT MARSH
VEGETATION
1 LOW SAND MARSH
2 LOW SILT MARSH
3 SEDGE MARSH
4 IMMATURE HIGH MARSH
5 MATURE HIGH MARSH
6 BULRUSH & SEDGE
7 INTERTIDAL GRAVEL MARSH
8 DIKED MARSH
SCALE
WETLAND MAP
OF THE
SIUSLAW RIVER
STATE OF OREGON
DIVISION OF STATE LANDS
JULY 1978

DESCRIPTION OF WETLANDS

The Siuslaw estuary contains few areas of shallow water compared to other large estuaries in the coastal zone. Shallow water and tidelands occur in the upper bay, in South Slough, and in the lower portion of the North Fork. The bay contains 756 acres of tidelands. The Oregon Wildlife Commission and the Fish Commission have identified extensive areas of eelgrass in the central portion of the estuary, between Cox Island and the U.S. 101 bridge.

The Siuslaw estuary contains one of the largest and most diverse marsh expanses in the coastal zone. Six marsh types cover 1458 acres. Only the low sandy marsh and gravel marsh types are not found in this estuary.

The Siuslaw marshes occur in two major components, one expanse consisting of Cox Island and adjacent islands and sloughs in the main channel area, and a large expanse in the tidal portion of the North Fork. Cox Island is the dominant marsh feature, a 170 to 200-acre expanse of immature high marsh fringed with sedges in the numerous channels and ditches extending through the Island. Upstream from Cox Island are large islands of sedge marsh and an 80-acre expanse of bullrush and sedge marsh between the railroad bridge and Cox Island.

The North Fork area contains a large 90-acre expanse of mature high marsh, a 50 acre island of sedge marsh, and one 50-acre expanse of immature high marsh.

Extensive diked marsh areas are evident on both the main stem of the river and in the upper areas of tidal influence on the North Fork. The relatively large areas of bullrush and sedge marsh indicate fresh water influence in these diked areas.

LAND OWNERSHIP

The southern margin of the lower estuary is in federal ownership. Nearly all of the marsh areas of the estuary are in small private or corporate (timber) ownership.

TIDELAND OWNERSHIP

Tideland ownership is fragmented. Most of the tidelands surrounding Cox Island and adjacent to the other marsh tracts are privately owned.

LAND USE AND USE IMPACTS

Considerable modification of marshes has occurred in the past through agricultural uses. Current pressures are from residential and commercial demands. Future demands for modification may come from dredge spoils disposal, log storage, marinas and related commercial development, and a variety of industrial and urban uses in the accessible areas along the north margins of the estuary and the west margins of the North Fork.

Domestic sewage from the Mapleton area has been noted as a problem by the Oregon Wildlife Commission.

Wetlands of Umpqua Bay

LOCATION AND EXTENT

The Umpqua River enters the Pacific Ocean approximately 4 miles west of the city of Reedsport in western Douglas County. The estuary is the fourth largest in the coastal zone, covering over 6,830 acres.

PHYSICAL CHARACTERISTICS

The Umpqua River rises in the Cascade Mountains and drains a watershed area of over 4,500 square miles, most of which is east of the crest of the Coast Range. Sedimentation from the drainage basin averages 564,000 tons per year. However, the fresh water flow averages 6,700,000 acre-feet per year, and tideflats occupy less than one-quarter of the estuary.

FISH AND WILDLIFE

The Oregon Wildlife Commission estimates the spawning populations of the Umpqua watershed to include:

(1) 24,000 Coho Salmon;

(2) 12,000 Spring Chinook Salmon;

(3) 3,000 Fall Chinook Salmon;

(4) 40,000 Winter Steelhead Trout;

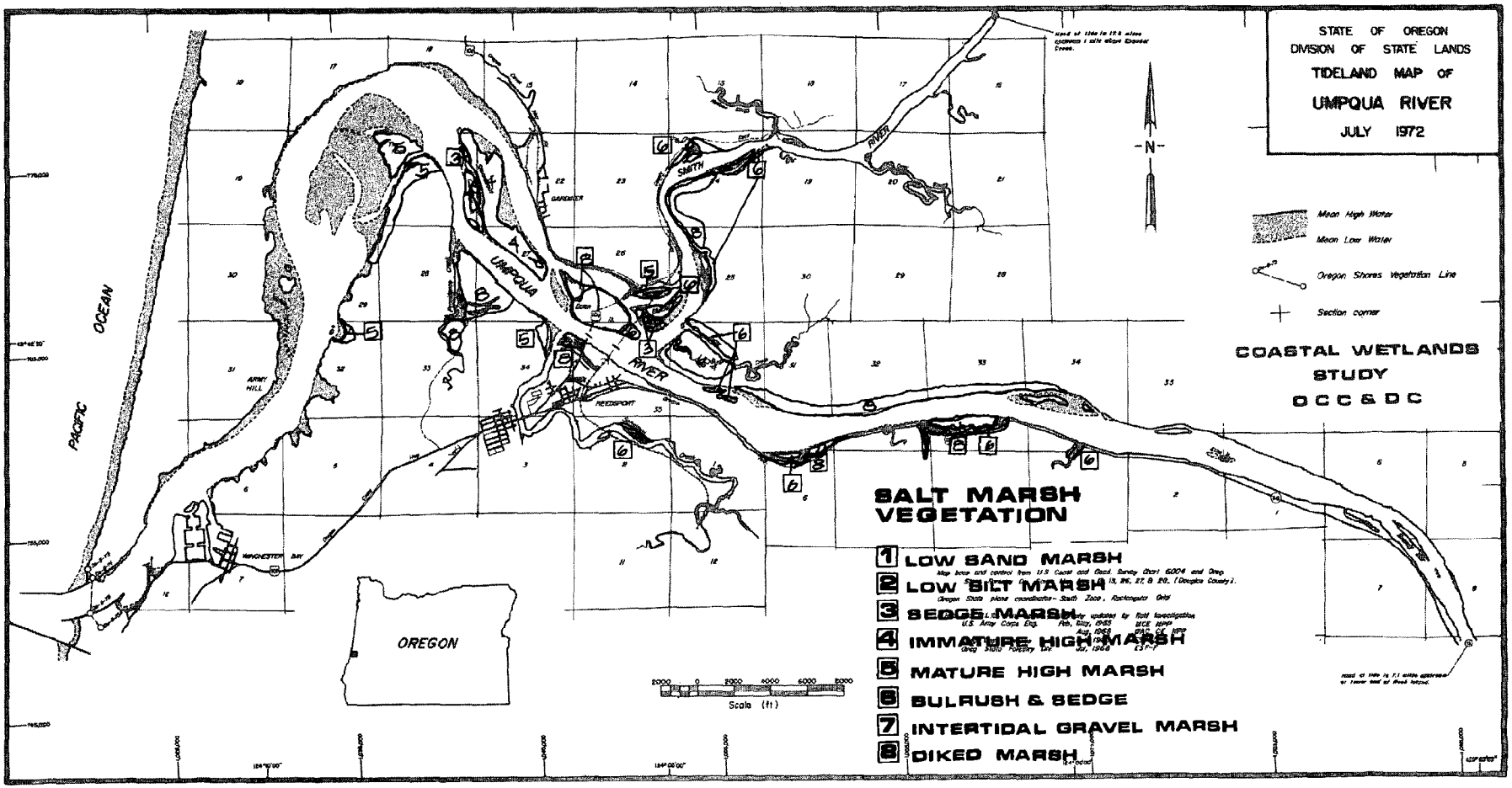
(5) 13,500 Summer Steelhead Trout;

(6) 10,000 Cutthroat Trout;

(7) 44,000 Striped Bass; and

(8) 340,000 Shad.

The estuary is of importance to the scaup duck (bluebill). Ten to fifteen thousand of these birds winter in the estuary. Some Band-tailed pigeon use occurs in Hudson Slough of the Smith River portion of the estuary.


STATE OF OREGON
DIVISION OF STATE LANDS
TIDELAND MAP OF
UMPQUA RIVER
JULY 1972
N
Mean High Water
Mean Low Water
Oregon Shores Vegetation Line
Section corner
COASTAL WETLANDS
STUDY
OCC&DC
SALT MARSH
VEGETATION
1 LOW SAND MARSH
2 LOW SILT MARSH
3 SEDGE MARSH
4 IMMATURE HIGH MARSH
5 MATURE HIGH MARSH
6 BULRUSH & SEDGE
7 INTERTIDAL GRAVEL MARSH
8 DIKED MARSH
PACIFIC OCEAN
UMPQUA RIVER
SMITH RIVER
OREGON
WINCHESTER BAY
REEDSPORT
GARDNER
ARMY HILL
Scale (ft)

DESCRIPTION OF WETLANDS

The Umpqua estuary has been described as a fresh water channel affected by tidal action. The type and distribution of wetlands in Umpqua Bay demonstrate the fresh water and strong current aspects of this estuary. Shallow water areas occur around the islands and along the margins where deposition has resulted in 1531 acres of tidelands. Eelgrass beds are limited to these shallow areas in the lee of islands and within the numerous coves of the lower bay.

There are 344 acres of tidal marsh in the estuary. The dominance of fresh water is noticeable in the upper bay. Bullrush and sedge marsh is dominant in both the Umpqua and Smith Rivers above Reedsport, with a comparatively large area of 45 acres occurring along Butler Creek. Another area of bullrush and sedge marsh occurs on the east tip of Bolon Island. With the exception of a few islands of sedge marsh in the mouth of the Smith River, the lower bay (below Reedsport) is dominated by high marsh. Steamboat Island consists of a 60-acre expanse of immature high marsh. A 55-acre tract of mature high marsh occurs on The Point and adjacent uplands.

Extensive areas of diked marsh occur throughout the estuary, including large segments along Providence Creek, Bolon Island, and along the east margins of the Smith River and the north margin of the Umpqua River.

LAND OWNERSHIP

With the exception of the Umpqua Spit, which is in federal ownership, the immediate uplands of the estuary are in small private and corporate ownership.

TIDELANDS OWNERSHIP

Tidelands in the lower bay (below The Point) are in state ownership, while those adjacent to Bolon and Steamboat Islands are in local government ownership.

LAND USE AND USE CONFLICTS

Primary use conflicts as indicated by the Oregon Wildlife Commission include gravel dredging in the upper bay, log storage, effluent from domestic and industrial sources, and demands for increased recreational boating facilities.

Wetlands of Coos Bay*

LOCATION AND EXTENT

Coos Bay enters the Pacific Ocean 7 miles west of the city of Coos Bay in northern Coos County. Coos Bay, covering 12,380 acres, is the largest estuary totally within Oregon.

PHYSICAL CHARACTERISTICS

Coos Bay receives the drainage of a watershed of approximately square miles. Sediment deposition in the estuary is estimated at 72,000 tons annually. There are also extensive areas of dredge spoils in the estuary and along the shorelines in a number of locations.

FISH AND WILDLIFE

The Oregon Wildlife Commission estimates the spawning population of the Coos Bay estuary watershed to include:

(1) 8,300 Coho Salmon;

(2) 500 Fall Chinook Salmon;

(3) 5,000 Steelhead Trout; and

(4) 3,500 Sea-run Cutthroat Trout.

Other fish in the bay of importance to sportsmen include sea perch, sculpin, and especially striped bass and shad.

Coos Bay is of special importance to migrating waterfowl because of the extensive areas of eelgrass present and the relative scarcity of large bays available for feeding and resting in the northern California-southern Oregon portion of the Pacific Coastal Flyway. The Oregon Wildlife Commission estimates a peak of 15,000 waterfowl-use days on the estuary. Important waterfowl areas of the estuary include South Slough, Marshfield Channel, Pony Slough and Jordan Cove.

* A natural resource inventory of this estuary entitled *Natural Resources, Ecological Aspects, Uses and Guidelines for the Management of Coos Bay, Oregon,* was completed by the U.S. Department of the Interior in 1971.

DESCRIPTION OF WETLANDS

Coos Bay contains a great amount of shallow water in the main embayment of the estuary (adjacent to the cities of North Bend, Coos Bay and Eastside) and in North, South, Pony and Isthmus Sloughs and Haynes' Inlet. The majority of the bay's 6,200 acres of tidelands are in these areas and along the margins of the Marshfield Channel.

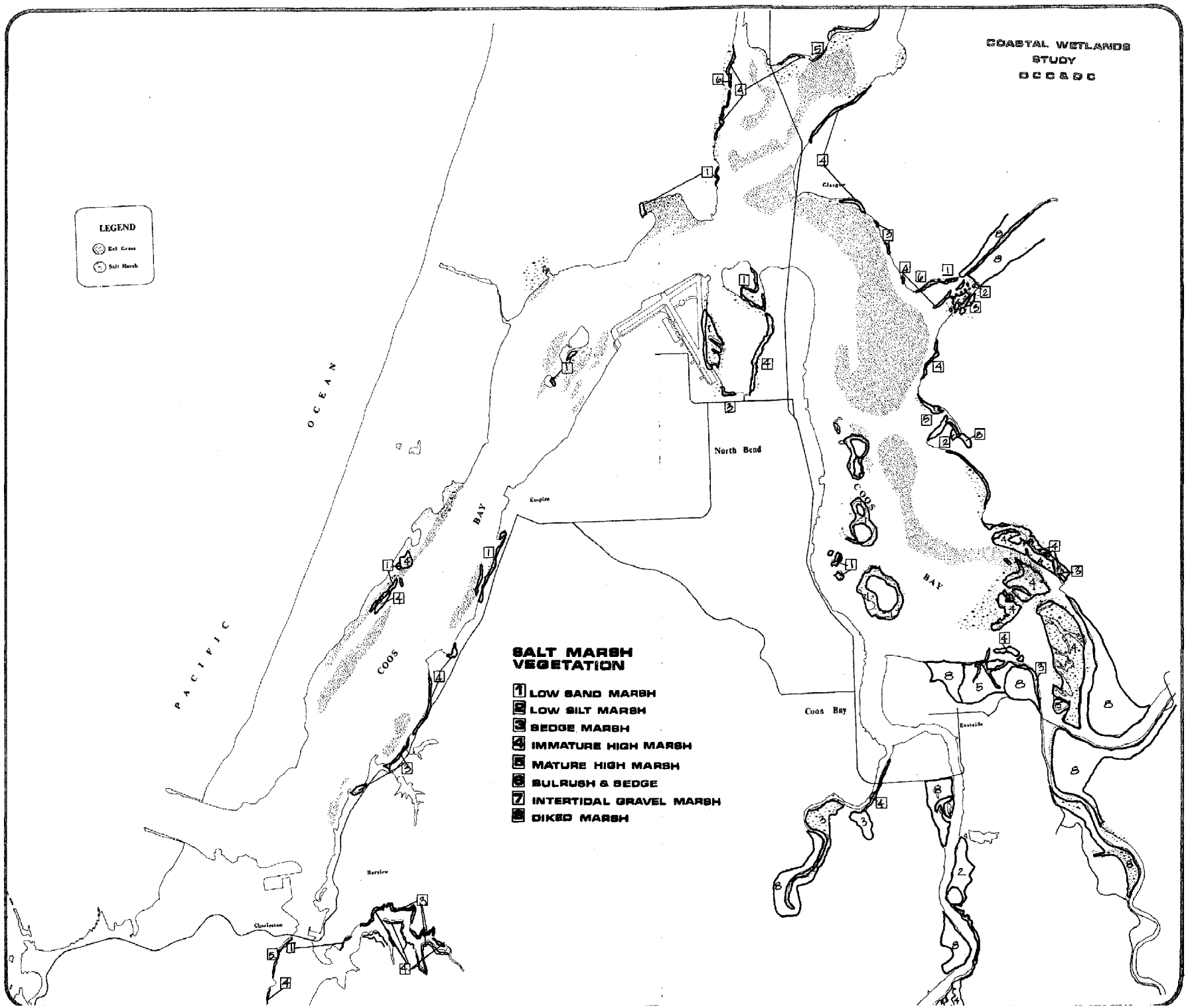
Because of strong tidal action and relatively higher salinity (compared to other Oregon estuaries) Coos Bay contains extensive areas of eelgrass, approximately 1,400 acres. These eelgrass beds are depicted in the recent report *Coos Bay Estuary* of the Fish Commission of Oregon, and are included on the accompanying maps in this report because they are so extensive as to be of major significance.

Nearly all of the 2,738 acres of tidal marsh in the Coos Bay estuary are located within the seven rivers and sloughs which enter the main bay.

The main exception is the Coos River delta area, where there are several extensive islands of immature high marsh. The east margin of the bay in this vicinity contains a large immature high marsh which is fringed with sedge marsh. An extensive diked marsh area is located on both sides of the Coos River and Catching Slough. The flats north of Eastside contain a large area of mature high marsh and a number of islands of immature high marsh. However, most of the marsh in this area is diked. Marsh areas which previously existed in this part of the bay (in the vicinity of Eastside and Coos Bay) have been covered by urbanization. Johannessen (1961) states that the original extent of marsh in the Coos Bay-Bunker Hill areas may be delimited by the margin of the older residential districts. The status of the wetlands in this part of the estuary may be characterized as expanding on the southeast margins of the bay and decreasing on the southwest.

Three large (and several small) islands of dredge spoils are located in the main bay adjacent to the south end of the city of Coos Bay. Low sand marsh vegetation occurs on the margins of all these islands. The interiors of these islands are generally elevated well above submergence levels and as a result, are covered with species of upland vegetation.

Kentuck Slough has been diked and modified extensively, and the current pattern at the mouth of the Slough has been altered considerably. Johannessen (1961) indicates these changes have brought about a rapid expansion of the marsh at the mouth of the inlet, in effect a doubling of marsh area between 1939 and 1961.


COASTAL WETLANDS
STUDY
OCCOG
LEGEND
Eel Grass
Salt Marsh
PACIFIC
OCEAN
COOS
BAY
North Bend
Empire
Glasgow
Coos Bay
Eastside
Barview
Charleston
SALT MARSH
VEGETATION
1 LOW SAND MARSH
2 LOW SILT MARSH
3 SEDGE MARSH
4 IMMATURE HIGH MARSH
5 MATURE HIGH MARSH
6 BULRUSH & SEDGE
7 INTERTIDAL GRAVEL MARSH
8 DIKED MARSH

There are extensive marsh areas still remaining in Isthmus Slough, despite the intensive diking and filling of wetlands which have occurred between the mouth of the slough and the Coos city Bridge. The lower slough (between Hayden and Coos Bay) is dominated by diked marsh, sedge marsh, a large fringe of immature high marsh on the east margin of the Slough across from Millington, and a large area of low silt marsh about a mile south of Eastside. The entire Shinglehouse Slough area is dominated by a large sedge marsh.

Above the Coos city bridge, the Slough contains primarily bullrush and sedge marsh, indicating the increasing dominance of fresh water.

Coalbank Slough contains two large remnants of sedge marsh adjacent to the city of Coos Bay, while the upper portion of the slough has been diked. Pony Slough is fringed on the east and west sides with narrow bands of immature high marsh, and on the west side by an expanse of low sand marsh. These relatively small marsh areas are important because of the heavy use of Pony Slough by waterfowl, especially during stormy periods when the slough offers protection from the high waves of the main bay. Pony Slough is currently managed by the State of Oregon as a wildlife refuge.

An extensive road dike system has separated both Haynes Inlet and North Slough from full exposure to the main bay, and both of these contain large areas of tideflats. Haynes Inlet is fringed with mature and immature high marsh on both sides from the U.S. 101 fill to the edge of tidewater, which is dominated by a sedge marsh. Extensive areas of diked marsh occur in the upper area of the slough.

North Slough contains a large expanse of intact, unfragmented and diverse tidal (and non-tidal) marsh. The east margin of the slough is dominated by a large sedge marsh and immature high marsh. The west margin contains large areas of bullrush and sedge marsh, and mature and immature high marsh. The Southern Pacific railroad dike provides a distinct boundary between fresh water and salt water influence in the North Slough marsh community.

South Slough, along with North Slough, is an estuarine environment of major significance. North Slough is important for the large, unbroken area of tidal marsh it contains, while the value of South Slough derives from large areas of undisturbed tideflats and extensive fringe marshes. Nowhere in South Slough is there a single large tract of marsh (over 10 acres) yet, nearly the entire slough is fringed with mature and immature high marsh, creating a total wetland area of major importance. The functions and values of fringe marshes as

"edge environments" important to wildlife and as buffers from storm waves (and particularly erosion) has been discussed previously.

In Joe Ney Slough, the lower margins are fringed with low sand marsh and immature and mature high marsh, while the upper margins are fringed with sedges. The extreme upper end of the slough is a diked area.

The main channel area of Coos Bay (between the North Bend airport and Charleston) is almost devoid of tidal marsh. The east margin of the channel (visible from the Empire-Charleston Highway) is fringed with a narrow band of low sand marsh (near Empire) immature high marsh (near Sitka Dock) and sedge marsh (on both sides of Pigeon Point).

LAND OWNERSHIP

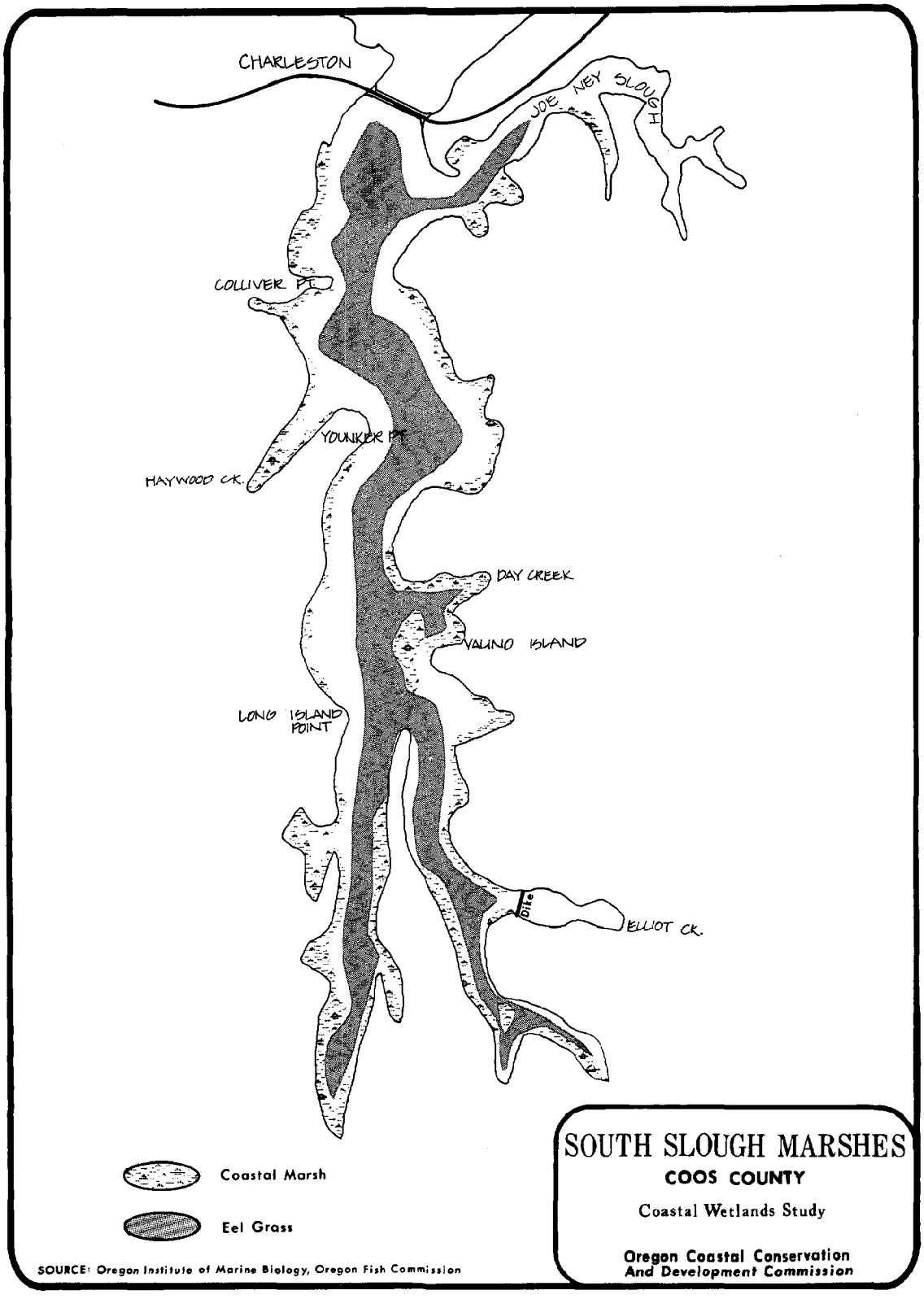
With the exception of the North Spit and the Pony Slough areas which are in public ownership, most of the uplands adjacent to the Coos Bay estuary are privately owned. The majority of this is in individual private holdings, although large tracts of corporate ownership are located in the Coos River delta, North Slough-Haynes Inlet, and South Slough areas.

TIDELANDS OWNERSHIP

The pattern of tidelands ownership in Coos Bay is complex. Major areas in private ownership include Isthmus Slough, most of the Coos River delta area, the Kentuck Inlet-Glasgow portion of the main bay, and North Slough. Areas of local government ownership include the main bay north of Coos Bay and Eastside, Pony Slough and Jordan Cove. State tidelands ownership includes part of the Coos River delta, Catching Slough, Shinglehouse Slough, Haynes Inlet north of the channel, and much of South Slough.

LAND USE AND USE CONFLICTS

Historically, much of the marsh and tidelands of Coos Bay were diked and drained for pasture to support the active dairy industry. Additional areas were covered with the spoils which resulted from the constant dredging of navigation channels, and large areas of marsh and tidelands have been used for log storage. With the exception of South Slough, there are no major wetland areas of the Coos Bay estuary which have not been modified by man's activities. The presence of *Cotula*, or brass-buttons, a small yellow exotic plant native to South


CHARLESTON
JOE HEY SLOUGH
COLLIVER PT.
YOUNKER PT.
HAYWOOD CK.
DAY CREEK
VALINO ISLAND
LONG ISLAND POINT
ELLIOT CK.
Coastal Marsh
Eel Grass
SOURCE: Oregon Institute of Marine Biology, Oregon Fish Commission
SOUTH SLOUGH MARSHES
COOS COUNTY
Coastal Wetlands Study
Oregon Coastal Conservation And Development Commission

Africa (which prospers in marsh areas where wood waste materials are incorporated into the soil) throughout the Coos Bay estuary is indicative of the intense use which has been made of this area for logging, wood storage, processing and shipping. Unlike other estuaries, in which residential and recreational pressures dominate, the Coos Bay estuary will continue to be a center of marine industrial activities.

The estuary contains a large total area of tidal marsh, however, and extensive areas of tidelands and eelgrass. Relatively undisturbed tracts of tidal marsh and tidelands remain in North and South Sloughs, indicating the vitality of the wetlands system within a heavily-used estuary.

The North Slough is of particular significance as a visual asset, with the exposed sand of the Oregon Dunes National Recreation Area forming a backdrop to the extensive marshes clearly visible from U.S. 101, which forms the east border of the present marsh area. The marshes and associated dunes constitute (principally for south-bound U.S. 101 traffic) one of the most characteristic and scenic coastal landscapes available to the traveler. Although it is an outstanding community entrance resource for the Coos Bay urban area, the visual impact of this scenic landscape is diminished by the joint use of the area as a billboard corridor.

The Coos Bay Estuary Plan contains land and water use provisions for tidelands and marshlands, as discussed in the MANAGEMENT section of this report.

Coos Dunes Wetland Area*

LOCATION AND EXTENT

The Coos Dunes area extends from the North Spit of Coos Bay to Tenmile Creek, between U.S. 101 and the ocean shore in northern Coos County. Several large and numerous small inland marsh areas and some dunes, or deflation plain marshes occur throughout the area, totaling an estimated 1,000 acres.

PHYSICAL CHARACTERISTICS

The Coos Dunes area consists of active and older stabilized sand dunes, shore pine and spruce forests, and a large number of lakes. Formation of the area resulted from inland sand movement blocking seaward drainage from the Coast Range. Low-lying wetland areas are sustained by water storage in the dunes and water movement out of large Coast Range lakes.

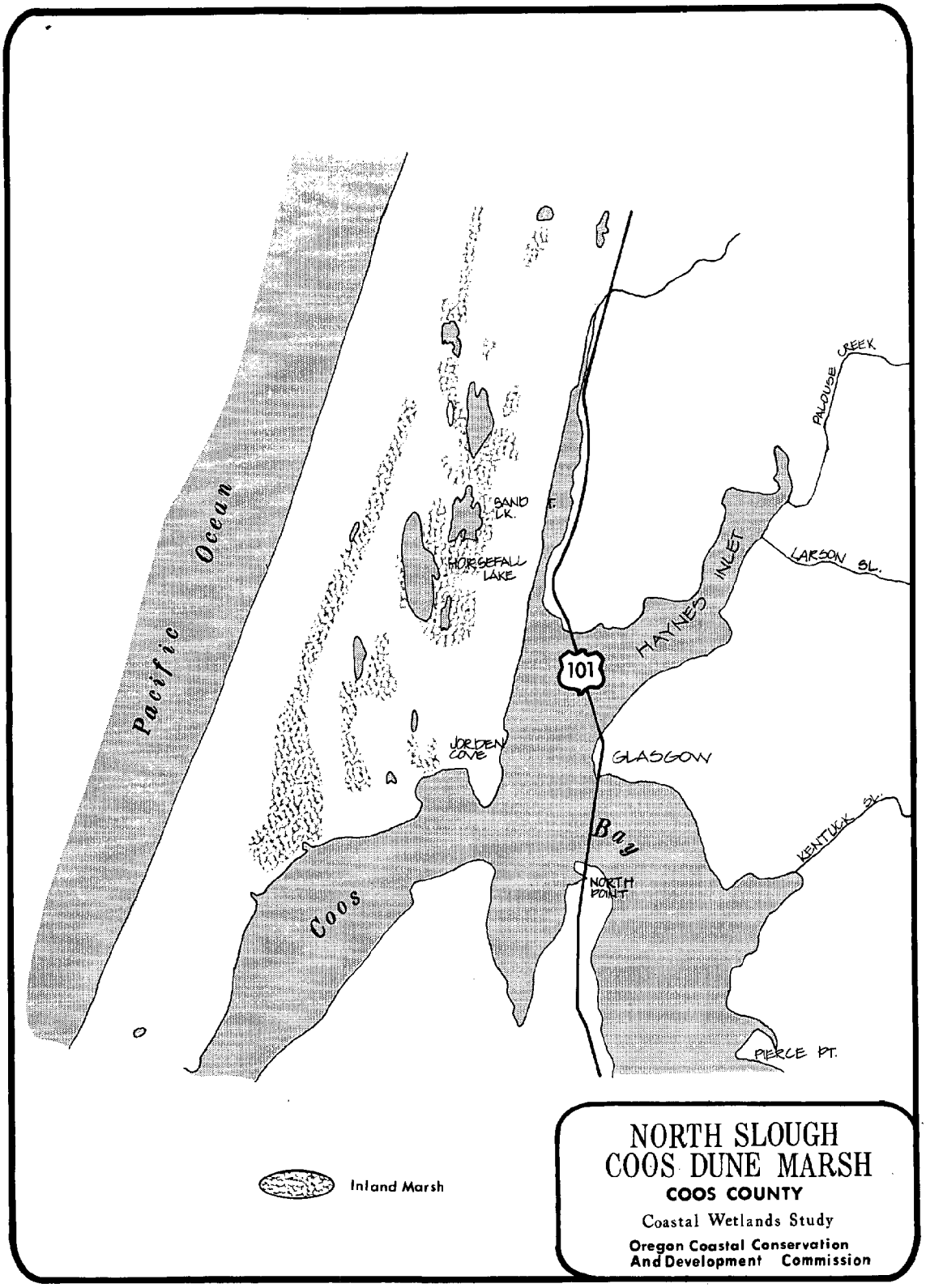
DESCRIPTION OF WETLANDS

The area contains several large inland marsh areas, extending from the Henderson Marsh near Coos Bay northward to Horsfall and Sandpoint Lakes, and numerous small valley marshes inland from the dunes sheet. Within the dunes are a number of deflation plain marshes. These areas are secluded and relatively inaccessible and have a high value for wildlife. Because of sand movement in this area, some of the shallow water areas are rapidly succeeding to shrub swamp communities.

LAND OWNERSHIP

This area contains a mixture of federal and private ownership. Many of the lakes in the area have been purchased and used as waterfowl hunting retreats. Except for the extreme southern portion, most of this area is included within the Inland Section of the Oregon Dunes National Recreation Area, which indicates that the national forest master plan for the area (to be completed in 1974) will determine the compatibility of proposed uses in this area.

*A detailed analysis of this area is available in the *Oregon Dunes National Recreation Area Inventory*, compiled by the staff of the Siuslaw National Forest.



NORTH SLOUGH
COOS DUNE MARSH

COOS COUNTY

Coastal Wetlands Study

Oregon Coastal Conservation And Development Commission

Wetlands of Coquille Bay

LOCATION AND EXTENT

The Coquille River enters the Pacific Ocean one mile west of the City of Bandon, in southern Coos County. The Coquille is one of the smaller estuaries in the coastal zone, covering approximately 771 acres.

PHYSICAL CHARACTERISTICS

The estuary receives an average of 100,000 tons of sediments each year from a watershed of 2,390 square miles. Much of the lower watershed is a broad marine terrace, formerly salt marsh, which has either matured to upland meadow or has been diked and drained for pasture. The Coquille has a sandy rather than silty substrate. Logging and burning in the watershed resulted in a period of intense flooding and siltation in the past. Johannessen (1961) indicates large areas of the estuary have silted in since 1895.

FISH AND WILDLIFE

The Oregon Wildlife Commission estimates the spawning population of the Coquille estuary to include:

(1) 23,000 Coho Salmon;

(2) 4,900 Fall Chinook Salmon;

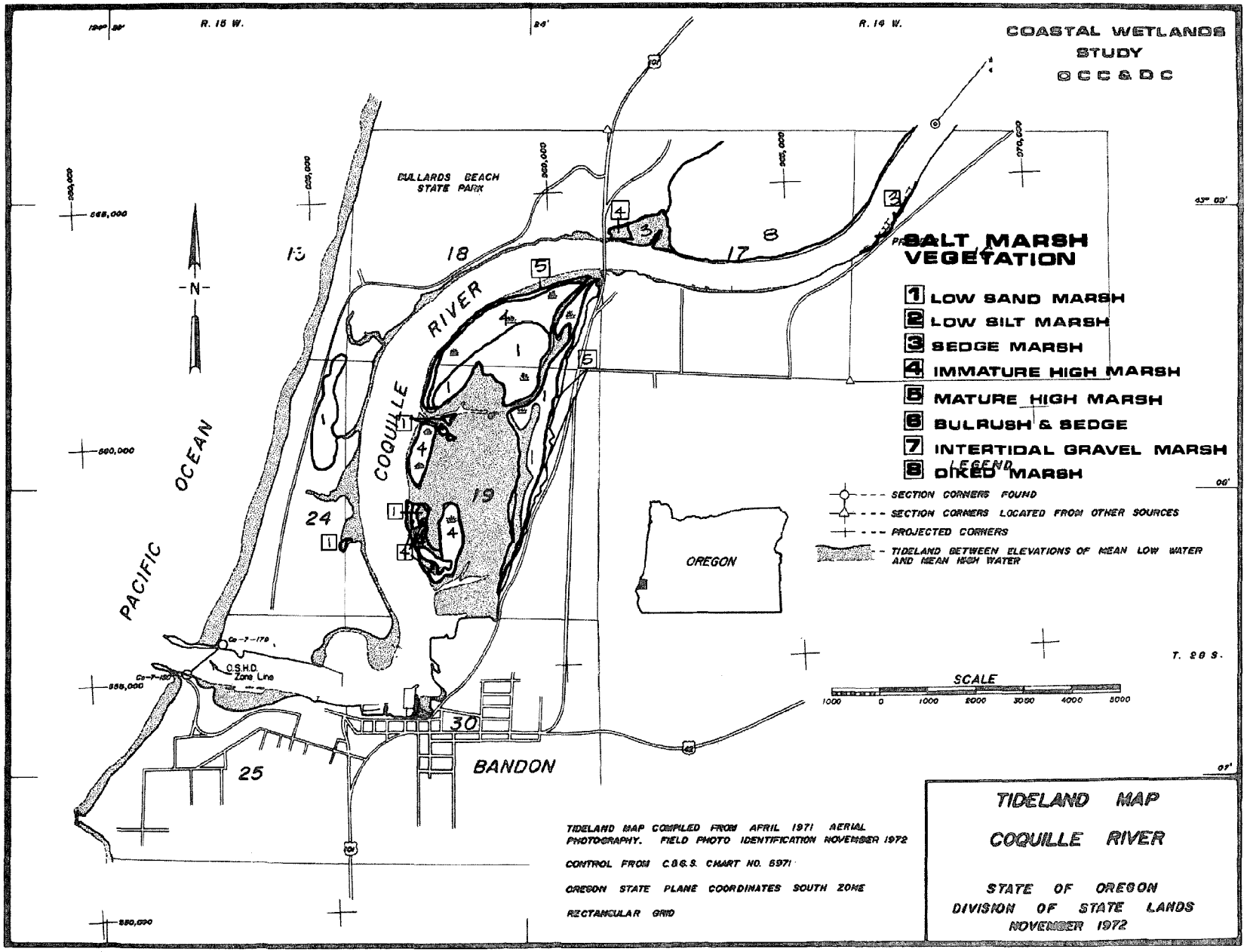
(3) 16,000 Steelhead Trout;

(4) 12,000 Cutthroat Trout.

Striped bass and shad spawn in the estuary.

The bay is not of major importance to waterfowl, although several species (including widgeon and pintails) winter in the area. Wet meadows in the upper bay are used by many thousands of feeding waterfowl. Band-tailed pigeons are found in the vicinity of Prosper in the upper bay.

One large area of shallow water occurs in the embayment north of Bandon. Most of the 301 acres of tidelands in the estuary occur in this area also. The Oregon Fish Commission maps indicate three large beds of eelgrass along the east margin of the bay between Bandon and the U.S. 101 bridge.


COASTAL WETLANDS
STUDY
OCC&DC
R. 15 W.
R. 14 W.
BULLARDS BEACH
STATE PARK
COQUILLE RIVER
PACIFIC OCEAN
OREGON
O.S.H.D.
Zone Line
BANDON
SALT MARSH
VEGETATION
1 LOW SAND MARSH
2 LOW SILT MARSH
3 SEDGE MARSH
4 IMMATURE HIGH MARSH
5 MATURE HIGH MARSH
6 BULRUSH & SEDGE
7 INTERTIDAL GRAVEL MARSH
8 DIKED MARSH
LEGEND
SECTION CORNERS FOUND
SECTION CORNERS LOCATED FROM OTHER SOURCES
PROJECTED CORNERS
TIDELAND BETWEEN ELEVATIONS OF MEAN LOW WATER AND MEAN HIGH WATER
SCALE
1000 0 1000 2000 3000 4000 5000
T. 28 S.
TIDELAND MAP
COQUILLE RIVER
STATE OF OREGON
DIVISION OF STATE LANDS
NOVEMBER 1972
TIDELAND MAP COMPILED FROM APRIL 1971 AERIAL PHOTOGRAPHY. FIELD PHOTO IDENTIFICATION NOVEMBER 1972
CONTROL FROM C.&G.S. CHART NO. 5971
OREGON STATE PLANE COORDINATES SOUTH ZONE
RECTANGULAR GRID

The Coquille estuary contains 373 acres of tidal marsh, including the major low sand marsh area in the coastal zone. Two major areas of this marsh type (totaling approximately 120 acres) are located in the lower bay north of Bandon. Three large areas of immature high marsh totaling approximately 75 acres are located adjacent to the low sand marsh. An extensive diked marsh area is located along the north margin of the upper bay above the U.S. 101 bridge.

Johannessen (1961) indicates that the low sand marsh has been expanding rapidly since 1895, as a response to the intense sedimentation which followed logging activities in the watershed. In 1895, only fringe marshes existed where the major marsh expanse in the large embayment north of Bandon occurs today. Johannessen indicates the rate of marsh expansion between 1887 and 1916 was approximately 70 feet per year (for a total of 1500 feet), and that this rate continued until about 1939. Since 1939, expansion has proceeded at about four to five feet per year.

LAND OWNERSHIP

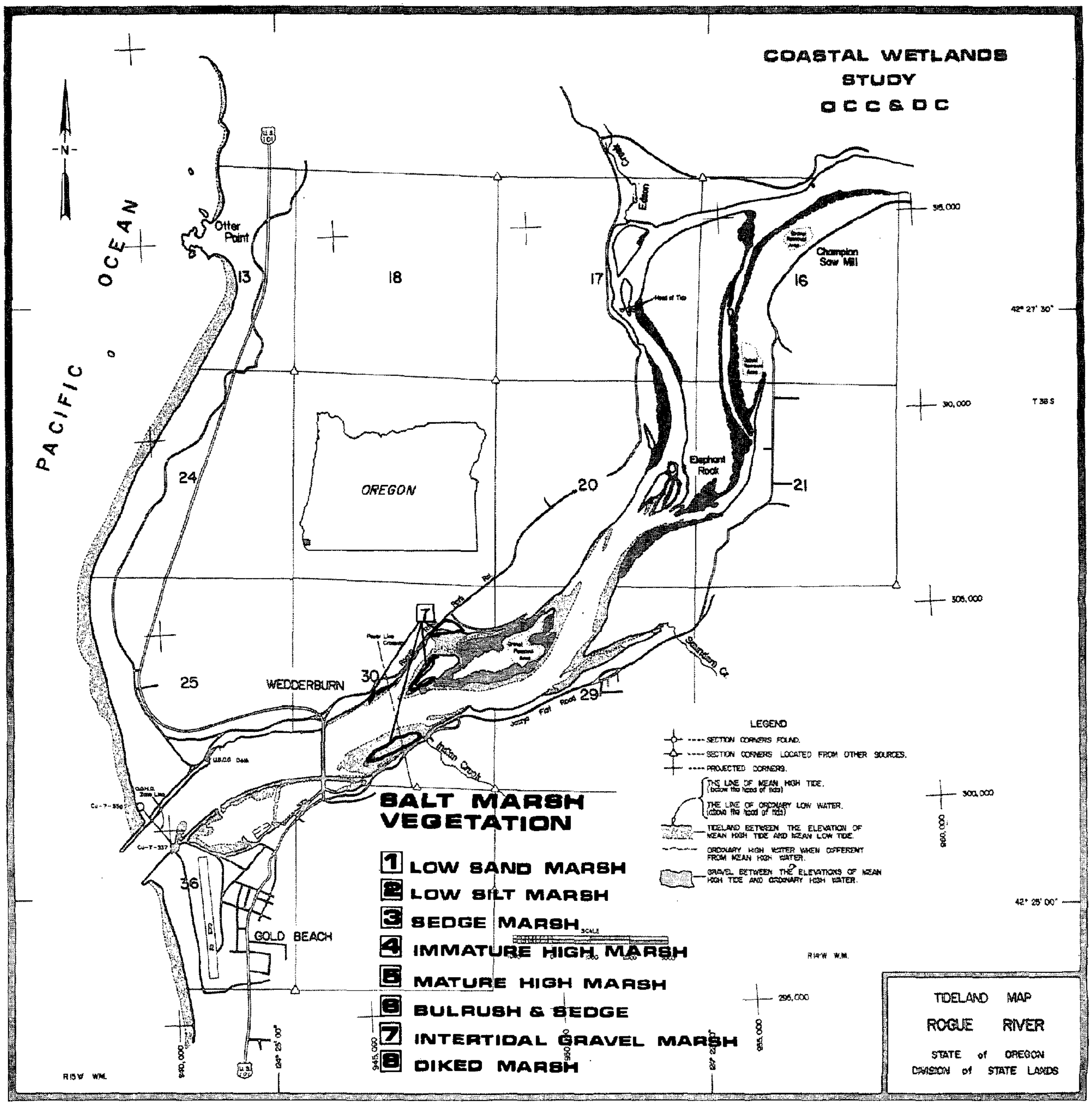
The uplands west of the estuary are in state ownership (Bullards Beach State Park). The remainder of the upland area is in private ownership.

TIDELAND OWNERSHIP

The tidelands adjacent to Bullards Beach State Park are in state ownership. Most of the remaining tidelands are in local government ownership.

LAND USE AND USE CONFLICTS

Primary conflicts in the past have resulted from log storage and some limited industrial effluent and wood waste disposal.



COASTAL WETLANDS
STUDY
OCC&DC
PACIFIC OCEAN
Otter Point
OREGON
Elephant Rock
Champion Saw Mill
WEDDERBURN
GOLD BEACH
Indian Creek
LEGEND
SECTION CORNERS FOUND.
SECTION CORNERS LOCATED FROM OTHER SOURCES.
PROJECTED CORNERS.
SALT MARSH
VEGETATION
1 LOW SAND MARSH
2 LOW SILT MARSH
3 SEDGE MARSH
4 IMMATURE HIGH MARSH
5 MATURE HIGH MARSH
6 BULRUSH & SEDGE
7 INTERTIDAL GRAVEL MARSH
8 DIKED MARSH
TIDELAND MAP
ROGUE RIVER
STATE of OREGON
DIVISION of STATE LANDS
R14W W.M.
R15W W.M.

Wetlands of the Rogue and Chetco Rivers

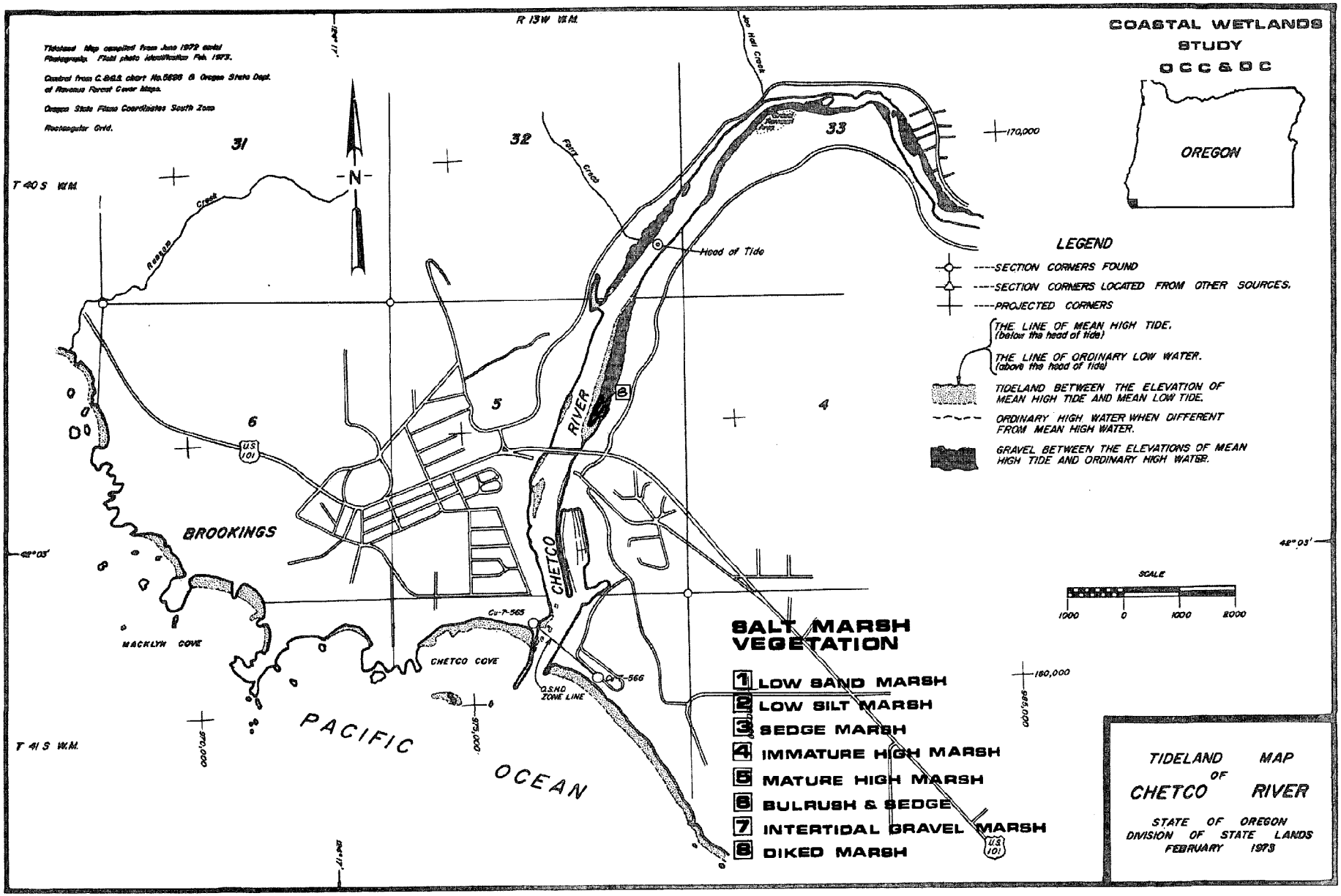
The Rogue and Chetco Rivers are located in southern Curry County, adjacent respectively to the cities of Gold Beach and Brookings. These rivers are primarily fresh water channels with a tidal bore which precludes extensive deposition of sediments. Large gravel deposits are common in the lower portions of both these rivers. The Chetco River contains only 12 acres of tidelands and the Rogue 149 acres. No eelgrass is present.

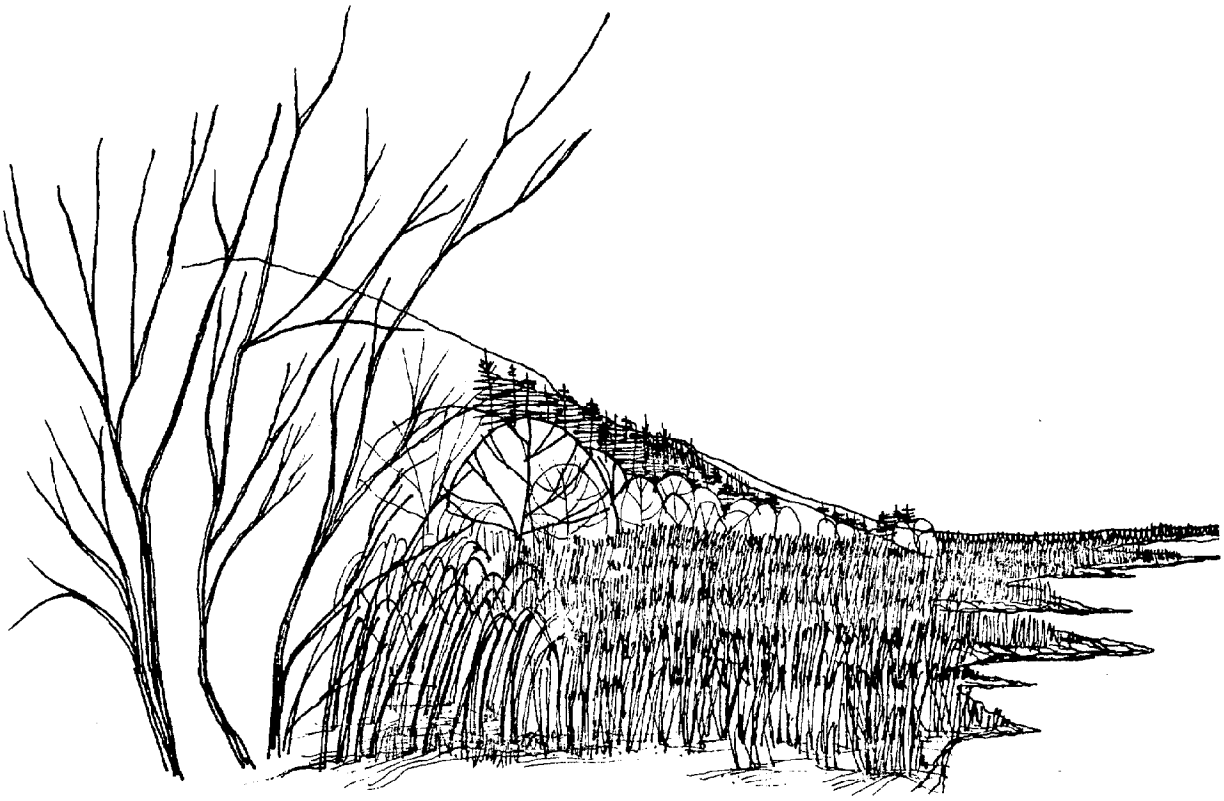
The gravel bars in each estuary support a few acres of a sparse marsh type which has been named "Intertidal Gravel Marsh" by Jefferson. This marsh type (as discussed previously) is a low-salinity community composed of spike rushes.

Both of these estuaries have significant fish and wildlife values which are sustained by the entire watershed and the marine environment.

Floras Lake - New River Marshes

A major area of inland marsh is located in the Floras Lake - New Lake area on the border between Coos and Curry Counties. The marsh has developed just inland from the primary dune. The area consists of approximately 400 acres in total of inland marsh. The marsh is important to migratory waterfowl, and is especially notable because it is somewhat inaccessible, providing freedom from harassment for many wildlife. The area is primarily privately owned, with some Bureau of Land Management ownership in the timbered uplands.


COASTAL WETLANDS
STUDY
OCC & DC
OREGON
R 13W W.M.
T 40 S W.M.
T 41 S W.M.
31
32
33
6
5
4
Rogue
Pistol Creek
Hooks Creek
Head of Tide
RIVER
CHETCO
BROOKINGS
MACKLYN COVE
CHETCO COVE
Cu-P-565
Cu-P-566
O.S.H.D. ZONE LINE
PACIFIC OCEAN
U.S. 101
42°03'
124°17'
170,000
160,000
SCALE
1000 0 1000 2000
LEGEND
----SECTION CORNERS FOUND
----SECTION CORNERS LOCATED FROM OTHER SOURCES.
----PROJECTED CORNERS
THE LINE OF MEAN HIGH TIDE. (below the head of tide)
THE LINE OF ORDINARY LOW WATER. (above the head of tide)
TIDELAND BETWEEN THE ELEVATION OF MEAN HIGH TIDE AND MEAN LOW TIDE.
ORDINARY HIGH WATER WHEN DIFFERENT FROM MEAN HIGH WATER.
GRAVEL BETWEEN THE ELEVATIONS OF MEAN HIGH TIDE AND ORDINARY HIGH WATER.
SALT MARSH VEGETATION
1 LOW SAND MARSH
2 LOW SILT MARSH
3 SEDGE MARSH
4 IMMATURE HIGH MARSH
5 MATURE HIGH MARSH
6 BULRUSH & SEDGE
7 INTERTIDAL GRAVEL MARSH
8 DIKED MARSH
TIDELAND MAP OF CHETCO RIVER
STATE OF OREGON
DIVISION OF STATE LANDS
FEBRUARY 1973



MANAGEMENT. . .

MANAGEMENT NEEDS AND GOALS

The overriding goal of coastal zone management is to maintain and protect the essential character and quality of the coastal environment, the basic support system for man's use of the coastal zone. This goal is inherent in the OCC&DC legislative charge which states that the Commission is to "Study the natural resources of the coastal zone and recommend the highest and best uses of such resources" (ORS 191.140). In the event of conflicting uses, the Commission is to establish a "...system of preferences between such conflicting uses that are consistent with the control of pollution and the prevention of irreversible damage to the ecological and environmental qualities of the coastal zone " (ORS 191.150). Another major part of OCC&DC's legislative charge is to provide "... the necessary balance between conflicting public and private interests in the coastal zone" (ORS 191.110).

Managing the wetlands resource presents a major example of the conflict between conservation and development. While wetland functions and values represent a resource of major significance to the general public, "...it is frequently difficult for the owners of marshes (and other wetlands) to capture any significant portion of the benefits of their property when it is in the form of wetlands" (Goldstein, 1969).

When the public seeks to preserve the inherent functions and values of wetland areas, there is often a conflict with the assumed right of private landowners to do whatever they wish with their wetland holdings. Because much of the wetlands resource is shoreland, there has been considerable purchase of these areas in anticipation of filling and the providing of services for residential and other development.

Despite the values of these areas to the public, and the hazards to development they generally present, there has been little guidance in the past from federal and state government regarding protection of wetland areas.

The private landowner has been, in effect, either directly or indirectly encouraged to convert wetlands to other forms of land which will produce economic benefits directly to him.

Recent policy statements from federal agencies (such as the U.S. Environmental Protection Agency) indicate a possible change in this trend. Also a number of the states have recently established wetland protection goals. The Executive Department of the State of Oregon recently published a document entitled *Oregon Areas of Environmental Concern* which describes wetlands protection as a goal of state-wide significance. Although this document is primarily informational, it indicates a concern and interest on the part of state government which could develop into an adopted state-wide policy in the near future.

The basic goal for wetlands management, therefore, is seen as the protection of inherent functions and values of the resource, while providing opportunities for resource use. Additionally, OCC&DC must approach this goal from a regional, coast-wide perspective. The importance of this is demonstrated in the relative distribution of wetlands along the coast, in that Curry County contains almost no tidelands, eelgrass or tidal marsh areas, and (excluding the Columbia River) Lincoln and Tillamook Counties contain a major portion of these resources. Thus in the regional context, wetlands use must be, consistent with the overall resource management system being developed coast-wide by OCC&DC.

These *regional* goals include:

(1) Maintaining a diversity of habitats for the plant and animals of the coastal zone;

(2) Identification of fragile environments and critical habitats;

(3) Identification of areas hazardous or inherently unsuitable for development;

(4) Prediction of changes in the environment through natural processes (such as plant succession), or alteration of water quality, or erosion, and evaluation of the management implications of those changes; and

(5) Identification of methods of restoring an environmental resource or increasing the capacity of the resource for desirable uses.

EXISTING FEDERAL MANAGEMENT POLICY

Previous federal leadership in wetlands management has come primarily from the U.S. Fish and Wildlife Service, an agency long concerned with the destruction of waterfowl habitat. The service coordinated the 1954 survey of wetlands in Oregon and in 1971 completed resource surveys in Coos Bay and Yaquina Bay which contained management recommendations for wetlands.

The U.S. Army Corps of Engineers, a major force in the conversion of wetlands to other uses nationwide, has indicated interest in the wetland inventory process. In a recent court decision in New Jersey, the Corps was upheld in extension of jurisdiction (as defined in the Rivers and Harbors Act of 1899) from mean high tide to the upland boundary.

The Soil Conservation Service, U.S. Department of Agriculture, has provided management recommendations for wet soils areas as part of soil survey interpretations for many years. The SCS is currently designing an extensive nationwide survey of wetlands based on the expertise of SCS soil scientists and U.S. Fish and Wildlife Service biologists. When completed, this survey could provide a large-scale description by county of undrained wet soils.

The involvement of the U.S. Environmental Protection Agency in wetlands management dates to February, 1973, when Agency Director William D. Ruckelshaus issued a decision statement regarding future EPA policy on waste-water discharges into wetland areas. This statement requires that EPA manage the construction grant program for sewage treatment facilities to prevent, wherever possible, the location of outfalls in areas where damage to the wetland ecosystem may occur. As stated in the Ruckelshaus decision:

> *Protection of wetland areas requires the proper placement and management of any construction activities and controls of non-point sources to prevent disturbing significantly the terrain and impairing the quality of the wetland area. Alteration in quantity or quality of the natural flow of water, which nourishes the ecosystem, should be minimized. The addition of harmful waste waters or nutrients contained in such waters should be kept below a level that will alter the natural, physical, chemical, or biological integrity of the wetland area and that will insure no significant increase in nuisance organisms through biostimulation.*

Other federal agencies have become involved in wetland inventory activities, but none of these have formulated definite management programs other than for problems encountered in relation to a specific project.

There have been several federal commission reports which have indicated the national interest in wetlands and other coastal resources. The Coastal Zone Management Act of 1972 is the most significant expression of federal interest in a comprehensive approach to the management of coastal resources.

EXISTING STATE LEVEL MANAGEMENT EXPERIENCE

As of December, 1972, twelve coastal states had instituted wetlands management programs; two had conducted a coastal wetlands study (Louisiana and Virginia); and one (Washington) had established guidelines for wetland areas within an overall shorelines management program (Bradley, 1972).

These management systems employed the use of the following techniques to assure resource protection:

(1) acquistion (Connecticut, Delaware, New Jersey, and North Carolina);

(2) permits (San Francisco Bay, Connecticut, Delaware, Georgia, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, North Carolina, and Rhode Island); and

(3) restrictive orders on specific uses in wetland areas (many coastal states).

In the past, the states of the Pacific Coast have been concerned almost exclusively with the protection of beaches. Acquisition, permit, and restrictive order programs have been used at the state and local levels to provide for the ever-increasing public demand for beach access.

In 1969, the San Francisco Bay Conservation and Development Commission established policies for the protection of 75 square miles of wetlands, the last remnants of a marsh expanse which once extended over 300 square miles in the bay area. Based on the inherent functions and values of the marsh areas, these policies require that any use (such as fills, piers or dikes) which interferes with resource values be prohibited

unless it is demonstrated to be clearly in the public interest, and if no alternative locations are available. Where loss of marshland is deemed necessary, an associated policy requires that former marshes be restored or new marshes created by deliberate placement of dredge spoils. Controls are administered by a permit system.

The California Game and Fish Department has been conducting an inventory of coastal wetlands for the past five years. With this inventory now complete, the Department is preparing area-by-area wetlands management plans. These inventories are available to other state agencies, local governments, and the state-wide and regional coastal commissions, who may use them to develop management guidelines.

The State of Washington has established wetlands management within a state-wide shorelines management system. Marshes, swamps and bogs are defined as "natural systems" to which the management program applies. State guidelines require local governments to prepare "master programs", or resource plans which define the permissible uses of the shoreline resource. There are four general management categories which might apply to a wetland area or any other "natural system". These are:

(1) *Natural Environment*

The natural environment is intended to preserve and restore those natural resource systems existing relatively free of human influence. Local policies to achieve this objective should aim to regulate all potential developments degrading or changing the natural characteristics which make these areas unique and valuable.

(2) *Conservancy Environment*

The objective in designating a conservancy environment is to protect, conserve and manage existing natural resources and valuable historic and cultural areas in order to ensure a continuous flow of recreational benefits to the public and to achieve sustained resource utilization.

(3) *Rural Environment*

The rural environment is intended to protect agricultural land from urban expansion, restrict intensive development along undeveloped shorelines, function as a buffer between urban areas, and maintain open spaces and opportunities for recreational uses compatible with agricultural activities.

(4) *Urban Environment*

The objective of the urban environment is to ensure optimum utilization of shorelines within urbanized areas by providing for intensive public use and by managing development so that it enhances and maintains shorelines for a multiplicity of urban uses.

Thus, Washington recognizes a range of functions and values for coastal resources, and provides an appropriate range of management categories.

The experience of coastal states in wetlands management may be summarized by a review of the basic components of the individual programs, which usually include:

(1) A legal definition of wetland areas of concern to the state;

(2) An inventory of wetland areas;

(3) Establishment of state authority over those areas, generally by special legislation;

(4) Institution of a permit and/or restrictive orders procedure to control large-scale disturbance of wetland areas;

(5) Assignment of administrative responsibility to a state agency (generally a natural resources or environmental quality agency) having comprehensive rather than single-purpose, planning and management responsibilities; and

(6) Testing and refinement of the wetlands management system in the courts, which have generally upheld both the state's authority to protect the public interest in maintaining the functions and values of wetlands, as well as the private landowner's right to receive compensation for what (in some individual cases) is interpreted as taking without compensation.

EXISTING WETLANDS MANAGEMENT IN OREGON

State Level

The current statutory authority of state agencies in Oregon which may apply to wetlands management include:

(1) ORS 537.525, requiring the State Engineer to determine, maintain and protect the quality of "reasonably stable" ground water levels (which may apply to the maintenance of inland fresh marsh areas);

(2) ORS 449.765, requiring the Department of Environmental Quality to adopt and enforce minimum standards for solid waste disposal (which applies to the filling of wetlands with refuse, particularly wood waste); and

(3) ORS 541.625, requiring the Director of the Division of State Lands to administer a permit system for fill and removal in the beds and banks of state waters (which may apply to the protection of the shallow estuary waters, tidelands, eelgrass, and low tidal marsh wetland types and subtypes).

Protection of wetlands has been a major interest of the Oregon Wildlife Commission, and the Oregon Fish Commission,

both of which lend staff assistance to the Division of State Lands in assessing potential impacts of fill and removal proposals on fish and wildlife values.

The Oregon Wildlife Commission is currently preparing a state-wide Fish and Wildlife Plan which should provide considerable guidance in protecting inherent functions and values of the nine wetland types which are discussed on a state-wide basis.

Local Level

The Lincoln County and Western Lane County Planning Commissions each have developed the county-wide zoning ordinances which include wetland management provisions. Oregon's other coastal counties do not have such regulations at present. However, in the summer of 1973, the Coos Bay Estuary Planning Committee developed a zoning category which would provide regulation of wetland areas if formally adopted by the County. Also, the Phase I report of the Clatsop County Planning Commission contains criteria for management of wetland areas and provides a logical basis for the development of such regulatory controls.

The wording of these local regulations (as follows) indicates a developing concern for wetlands management in the Oregon Coastal Zone.

WESTERN LANE COUNTY PLANNING COMMISSION

> *The natural resource district is intended to protect areas having unique or irreplaceable natural resources which are vital elements for a safe, healthful and pleasant environment for human life. It is further intended to protect the delicate, complex, biotic relationships between the natural conditions of watersheds, forest lands, tidelands, shorelands, dunelands, wetlands and marshlands and the vegetation and wildlife supported by such watersheds and lands. To minimize the potential hazards of pollution, resource conversion and land development resulting from increases in human population, urbanization, income, leisure time and individual mobility, emphasis will be placed on limiting and regulating human activity*

in those areas where (1) the acceptable water quality of streams, lakes, estuaries or the ocean may be endangered; (2) watersheds and their streams or lakes are used for domestic water supplies; (3) vegetative cover is essential to maintain soil stability and prevent erosion; (4) natural conditions are vital for either aquatic or wildlife habitat; and (5) scenic quality or vistas or open space is unique and/or irreplaceable.

COOS BAY ESTUARY PLANNING COMMITTEE

The Committee recognizes the value of the overall estuarine system to the production of fish, shellfish, migratory fowl, shorebirds and small upland animals and notes that this system affects not only the local area but large areas of the Pacific Ocean and Pacific Coast Flyway. The resources of the estuary contribute to recreation pursuits and aesthetic qualities of the area and to the economy of the estuarine region. The Committee RECOMMENDS that existing marshland and tidelands as delineated previously in this report be protected from further destruction. Likewise, the Committee RECOMMENDS that further reduction of the tidal prism with its attendant flushing action within the bay, be avoided.

CLATSOP COUNTY PLAN PHASE I REPORT

Recommendations for wetlands (marsh, bog and swamp areas) include permitted and associated uses *(hunting, fishing, sailing, observing, scientific investigation, and certain types of agriculture); and* restrictions on use *(no on-site or peripheral development which will interfere with maintenance of the ecosystem, especially its water storage and wildlife maintenance ability).*

Recommendations for estuaries and tidelands include permitted and associated uses *(fishing, shellfishing and other harvesting,*

recreation, limited associated urban development) and restrictions on uses *(no development which reduces the ability of the estuary to support plant and animal life, such as dredging, filling, excessive recreation, or overharvesting).*

MANAGEMENT ALTERNATIVES

The adoption of a coastal zone management program by a state government represents a determination of policy regarding the future use and development of the coastal region. If the program is consistent with the basic concepts of coastal zone management, it is built from an understanding of the coastal environment, those factors which distinguish the coastal region from all other areas of the state.

There are a number of other factors which bear on the development of the management plan, and more importantly, in carrying it out. These include regional economic policy, determination of urban growth and non-growth areas, setting standards for water and sewer services, and transportation corridor and accessibility decisions.

In regard to these major issues, it must be recognized that despite the importance of wetlands in the coastal environment, few if any decisions in the past have been based on a concern for wetlands functions and values. And it seems apparent that wetlands management in the future will be accomplished as part of an overall resource management program, rather than as a separately-legislated concern, as has been the case in several other states.

Nevertheless, there are basic resource values and characteristics unique to wetland areas which should be emphasized within an overall management program. There must be a method of keeping these basic concerns in the forefront as considerations of ownership, land and water uses, special district proposals, and other requirements are evaluated by policy-makers in arriving at a coastal management program.

In evaluating this variety of concerns and arriving at a management decision for wetlands (or any other resource) on a regional and coast-wide basis, some of the inherent values discussed in this report will not be sustained. This is inherent in the concept of achieving a balance between conservation and development.

It must be recognized, however, in striving to achieve this balance, that there are many different wetland types and areas in the coastal zone, and a variety of management problems and opportunities associated with them. Arriving at a priority of areas based on inherent functions and values would provide guidance in evaluating wetlands as specific individual resources within the overall coastal zone management plan.

Because of the complexity of wetland resources, and the lack of wetlands management experience (both in Oregon and nationwide), it is assumed that there is probably no *single* best method of management which would result in the optimum protection and wide use of areas as complex as wetlands.

Additionally, within the coastal zone management program, wetland functions and values may not be regarded as the overriding concern in setting policy. Therefore, management alternatives are provided in order that a number of approaches may be considered. It must be emphasized that these alternatives are described only to provide an input into the overall management program which emphasizes wetland functions and values, not to describe the format of that program.

Levels of Responsibility

There are several levels of responsibility at which wetlands management decisions are made. Many of the problems of the past relate to a lack of agreement and coordination between the various levels of decision-making, rather than to the absence of knowledge or a desire to solve problems.

FEDERAL RESPONSIBILITIES

Congress has stated through the Coastal Zone Management Act of 1972, that coordination of state coastal zone management programs is a basic federal level responsiblity. Other responsibilities include:

(1) purchase of wetland areas to protect migratory bird flyways and fish passage areas of interstate, national and international significance;

(2) providing grants, loans and technical guidance to the states for wetlands management activities; and

(3) providing a clear statement of the national interest and priorities in preserving, conserving and developing resources, including wetlands.

STATE RESPONSIBILITIES

The state is by tradition and law the focal point of many resource management responsibilities. Under federal coastal zone management guidelines, the state is required to study the coastal zone, formulate a management plan, and institute a system of controls over permissible land and water uses in the coastal zone. It is essential at the state level (as well as at the federal and local levels) that controls correspond to the level of interest. The state has an obvious (although not specifically declared) interest in preserving inherent functions and values of wetlands which are of regional significance. These would include:

(1) protecting unique and fragile areas;

(2) preserving unique and endangered species;

(3) providing areas for nature study and scientific research;

(4) protecting areas of unusual scenic significance;

(5) providing for basic production and nutrient cycling processes in each estuary or local watershed environment;

(6) preventing unsuitable development in hazardous areas; and

(7) providing for adequate recreation experiences unique to the wetlands environment.

A basic problem in managing resources to provide for these interests is fragmentation. The wetlands resource encompasses functions of interest to perhaps a dozen state agencies. In other states, management has often been facilitated by vesting responsibility in a single agency, usually a department of natural resources having multiple-purpose planning authority over land, water and biological resources.

Another basic problem nationwide is the lack of a declaration of state policy regarding wetlands Although developers realize the state wildlife and fish commissions will oppose a development in wetland areas, they generally are unaware if this attitude is shared by other decision-makers in the state government. In other states, management efforts have often been preceded by a declaration of state policy for wetland areas, either by the legislature or the natural resources department. This declaration provides guidance for the development of management plans at the regional and local level, and provides support in future zoning appeals, acquisition efforts, and court cases.

LOCAL RESPONSIBILITIES

The majority of decisions regarding the use of wetland areas will be made at the local level. The consequences of those decisions will be felt primarily at the local level as well.

The basic local responsibilities for wetlands management include:

(1) participating in the development of a coastal management plan to assure that it reflects local concerns as well as state interests;

(2) identifying wetland areas of significance to the local economy and stating why such areas should be reserved for those interests;

(3) communicating to local residents the reasons for wetlands management guidelines and fostering a spirit of state/local partnership to implement those guidelines; and

(4) developing local plans and ordinances which express local concerns for the resource and which are compatible with any previously established state and federal policies for wetlands management.

Management Techniques

The management techniques which have been used in other state wetland management programs are:

(1) acquisition, or outright purchase;

(2) administration of a permit system;

(3) development of a system of restrictive orders;

(4) shorelines zoning;

(5) regional function

(6) comprehensive coastal zone management (which may include all of the above).

ACQUISITION

Wetland areas may be purchased by private organizations or by the public for wildlife refuges, scientific areas, or scenic corridors. In some states wetland areas are being purchased to establish "marsh banks" to assure the continued productivity of estuarine and offshore fisheries.

In Oregon, wetland acquisition has been undertaken only by the U.S. Fish and Wildlife Service. Although funds have not been appropriated for wetlands acquisition, the Oregon Attorney General has ruled that the State Parks Division could use park funds to purchase tidal wetlands if recreational shellfishing existed in the area (Power, 1972).

Some states (notably New York and Massachusetts) have entered into joint state-local wetland acquisition programs, with the state providing financial assistance to municipal townships for the purchase of wetlands of both local and statewide significance.*

Generally most states set out to acquire those wetlands which are so valuable that State control appears necessary to assure long-term preservation. In the Atlantic coastal states, wetlands management has often been the most important segment

*As of late summer, 1973, New York instituted a new wetlands inventory program designed to support eventual state acquisition and regulation of the coastal marshes of Long Island.

of the coastal program, and as a result, acquisition is a basic goal.

PERMIT SYSTEMS

At least eleven states have instituted permit systems for wetland areas. Some permit systems are designed as the control mechanism for uses in wetland areas, while others are designed to provide variances from other controls, such as restrictive orders. The permits are generally administered by a state agency, usually with criteria for approval which favor protection of the inherent functions and values of wetlands.

RESTRICTIVE ORDERS

Five states have instituted a system of restrictive orders to protect wetland areas. The system generally consists of a survey and mapping of wetland areas by an appropriate state agency, such as the Department of Natural Resources, and the recording of land use restrictions in those areas on the deeds of affected landowners.

The following is an example of the restrictive order procedure enacted by the New Jersey Legislature in 1970.

> *Upon the adoption of any such order (restrictions on land use in wetland areas) or any order amending, modifying or repealing the same, the commissioner shall cause a copy thereof, together with a plan of the lands affected,* including reference to the filed wetlands map or maps on which the same are shown *and a list of the owners of record of such lands, to be recorded in the office of the county clerk or register of deeds, where it shall be indexed and filed as a judgment, and shall mail a copy of such order and plan to each owner of record of such lands affected thereby.*

In New Jersey, as in most other states with permit and restrictive order systems, regulated activities include draining, dredging, excavation of soil, mud, sand and gravel, filling and dumping, discharging of liquid waste, erection of structures, driving of pilings, and the placing of obstructions. Agriculture and projects deemed necessary to the health and welfare of local residents are generally exempt from regulation.

SHORELINES ZONING

Several states, including Washington, have instituted wetlands management as part of state-wide shorelines zoning programs. These are designed to protect the inherent functions and values of shorelines, including both fresh water and salt water wetlands. In Washington, tidal marshes are described as "Shorelines of State-wide Concern" requiring a greater state involvement in the planning and regulation of these areas. Wetlands may be included in a shorelines management program by designation (indicating concern for inherent functions and values) or because they occur within a zone of proximity to a water body (indicating concern for the shoreland resource).

COASTAL ZONE MANAGEMENT

Approximately half of the coastal zone states are currently instituting coastal zone management programs (Bradley, 1972). The measure of protection afforded to any particular resource such as wetlands in these efforts depends on the overall orientation of the program. However, wetlands management often has a high priority because of the generally accepted importance of the inherent functions and values of these areas in the coastal system.

A usual procedure is for the state to determine overall policy for resource protection and use, with individual agencies and local governments preparing plans and ordinances to implement the program concepts. The advantage of a comprehensive planning program is that resources such as tidal marshes may be managed in relation to surrounding environments and resources, regional and state-wide patterns of land use, the requirements for economic development, and the resource use/environmental protection demands of residents of the entire state.

OTHER TECHNIQUES

Other management techniques which encourage the protection of wetland areas include:

(1) floodplain management (and zoning) which may treat wetland areas as flood protection resources;*

*A demonstration of the value of wetlands in this regard occurred in 1955 during a flood in the Pocono Mountains of Pennsylvania. The only bridges that survived the flooding were those downstream from cranberry bogs and swamps (Patrick, 1971).

(2) the purchase of easements;

(3) land use regulations which encourage shoreline development in clusters, using wetlands as open space;

(4) community land trusts, whereby municipalities acquire wetland areas outright or development rights to protect community interests in wetland values and to prevent unsuitable development;

(5) grant and loan clearinghouse activities at the federal, state and local levels which require a consideration of wetland functions and values in all publicly-funded development projects; and

(6) passage of environmental impact legislation at various levels which specifically include concern for wetland functions and values.

TOWARD A MANAGEMENT APPROACH

OCC&DC is required to recommend the best use of coastal resources, and in the case of conflicts, to establish a system of preferences consistent with the control of pollution and the protection of the ecological and environmental characteristics of the coastal zone.

Based on the previous discussion of wetland areas and the characteristics of resource and land and water use in these areas, it is suggested that three management categories be established for each category. These categories include:

(1) *Resource Protection Areas*

where the unique, fragile and valuable nature of the area dictates a management approach primarily exclusive *of all other uses;*

(2) *Resource Conservation Areas*

where varying measures of compatability exist between the inherent functions and values of the resource and the uses which man makes of it in that place, and

(3) *Resource Development Areas*

where exploitation may well provide economic gains in the public interest exceeding the inherent natural value of the resource.

A more detailed discussion regarding criteria for each of these categories and the application of management concerns discussed in this section will be contained in the RECOMMENDATIONS section of this report.

RECOMMENDATIONS

A RECOMMENDATIONS CHAPTER HAS BEEN COMPLETED AS PART OF THIS REPORT. BECAUSE THESE RECOMMENDATIONS MUST BE INTEGRATED INTO THE OCC&DC POLICY DEVELOPMENT PROCESS, AND BECAUSE THEY MUST BE EVALUATED AGAINST RECOMMENDATIONS FOR OTHER COASTAL RESOURCES, THEY ARE REGARDED AS PRELIMINARY, AND NOT INCLUDED HEREIN FOR PUBLIC DISTRIBUTION.

HOWEVER, COPIES OF THESE RECOMMENDATIONS MAY BE SECURED FROM OCC&DC ON REQUEST.

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APPENDIX. . .

APPENDIX 1

Wetlands Glossary

(Source: Coastal Wetlands of Virginia, Interim Report)

Amphipoda--large order of laterally compressed crustaceans with the first thoracic segment fused with the head and lacking a true carapace.

Anaerobic mud--sediment devoid of oxygen and rich in hydrogen sulfide.

Aquifer--permeable material through which ground water moves.

Autotrophy--a type of nutrition in which complicated organic molecules are synthesized from carbon dioxide and water.

Benthos--organisms associated with the bottom of a body of water.

Biogenic--resulting from the activity of living organisms.

Biological oxygen demand (BOD)--the oxygen required by aerobic organisms, as those in sewage, for metabolism.

Bloom--mass outbreak of phytoplankters in nutrient-rich waters.

Borrow pits--excavations from which fill material was removed.

Brackish--pertaining to the waters of bays and estuaries, salty but of lower salinity than sea water.

Compensation point--the light intensity at which the release of photosynthetic oxygen equals the utilization of respiratory oxygen.

Consumers--those organisms in an ecosystem which feed upon other organisms; often divided into primary consumers (plant eaters), secondary consumers (carnivores which eat primary consumers), etc.

Demersal--occurring on or near the bottom.

Detritus--fine particulate debris of organic or inorganic origin.

Ebb tide--the outgoing water (tide).

Ecology--the study of the relations of organisms to their environment.

Ecosystem--all organisms in a community plus the associated environmental factors.

Ecotone--transition area between two adjacent communities.

Epifauna--sessile or sedentary benthic organisms living on the bottom.

Estuary--tidal body of water linked to the sea at one end and measurably diluted by freshwater at the other.

Fastland--the land behind a marsh.

Fetch--the uninterrupted distance travelled by wind over water.

Filter feeder--an animal that obtains its food by filtering small particles from water.

Flagellates--microscopic protozoans and algae which use flagella (long whip-like structures) for locomotion.

Flood tide--the incoming water (tide).

Flotsam--materials found floating on the water.

Hammock--a woodland surrounded by marsh.

Heterotrophy--type of nutrition characteristic of animals and some bacteria and true fungi which depend on organic matter from other plants and animals for food.

Hydrography--the science of the measurement, description and mapping of the surface waters of the earth.

Infauna--benthic organisms which burrow into the bottom.

Intertidal--area on a beach between mean high water and mean low water.

Isopoda--large order of dorso-ventrally compressed crustaceans with the thoracic segment fused with the head, abdomen short, and some or all segments fused.

Littoral--intertidal.

Longshore currents--the flow of water parallel to a beach caused by waves approaching the beach at an angle.

Meroplankton--organisms in the plankton for only part of their life cycle.

Microbiota--microscopic plants and animals of a habitat or region.

Microfauna--microscopic animals of a habitat or region.

Mean higher high water (MHHW)--average height of the higher high waters at a place over a 19-year period.

Mean lower low water (MLLW)--average height of the lower low waters at a place over a 19-year period.

Monospecific community--a community dominated by one organism.

Nutrient transformation--the biotic cycling of nutrients from inorganic to organic compounds.

pH--a measure of the hydrogen ion concentration or the relative acidity or alkalinity of a solution; a pH of 7 is neutral, greater than 7 alkaline and less than 7 acid.

Photosynthesis--the process in green plants of utilizing radiant energy from the sun to synthesize carbohydrates from carbon dioxide and water.

Phytoplankton--microscopic algae and fungi suspended in the water column.

Poikilotherm--cold-blooded animal.

Productivity--the rate of energy storage of an ecosystem.

Primary productivity--total quantity of carbon fixed by photosynthesis per unit time. It is usually approximated by measuring dissolved oxygen evolved, amount of a radioactive C^{14} label taken up, or the standing crop of chlorophyll in a sample of phytoplankton.

Respiration--sum total of all chemical and physical processes by which organisms (plants and animals) utilize organic materials as sources of energy and heat; usually oxygen is used and carbon dioxide and water are the chief end products.

Rhizome--a root-like subterranean stem, commonly horizontal in position, which usually produces roots below and sends up shoots progressively from the upper surface.

Salinity gradient--a decrease in salinity with distance away from the sea.

Sediment--mineral or organic matter deposited by water, air, or ice.

Standing crop--the total weight of organisms present at any one time, usually expressed as dry weight.

Suspension feeder--filter feeder.

Swale--a low wet place.

Tidal prism--the volume of water between high and low tide.

Topography--the features, relations, or configurations of a structural entity.

Transpiration--the escape of water vapor from plants.

Trophic level--one of the several successive levels of nourishment in a food chain; plant producers constitute the first (lowest) trophic level and dominant carnivores constitute the last (highest) trophic level.

Turbid plumes--discharging water ladened with sediment.

Tychopelagic--a benthic organism which enters the water column.

Vascular plant--higher plant provided with conducting vessels.

Xerophyte--plant adapted to dry conditions.

Zonation--the occurrence of typical animals and algae on specific regions of a beach, piling, or any object in the water.

Zooplankton--floating or weakly swimming animals.

STORET RETRIEVAL
OREGON STATE GAME COMMISSION

DATE 04/24/73

HABITAT INVENTORY SUMMARY

ESTUARY AND BAY
OREGON COASTAL ZONE

000081248 TOTAL ACRES THIS RETRIEVAL

LOCATION STN NMBR	GME DST	MGT UNIT	CO.	D	R	HABITAT TYPE	1970 HABITAT TYPE ACRES	1970 PER-CENT	1980 HABITAT TYPE ACRES	1980 PER-CENT	1990 HABITAT TYPE ACRES	1990 PER-CENT	2000 HABITAT TYPE ACRES	2000 PER-CENT
0915	113	CLATSOP	24	01	1	ESTUARY AND BAY	23,581	29.0%	23,581	29.0%	23,581	29.0%	23,581	29.0
		CLTSP	COUNTY SUBTOTAL				23,581	29.0%	23,581	29.0%	23,581	29.0%	23,581	29.0
0996	113	CLATSOP	49	01	1	ESTUARY AND BAY	2,304	2.8%	2,304	2.8%	2,304	2.8%	2,304	2.8
0863	113	NESTUCCA	49	01	1	ESTUARY AND BAY	13,564	16.7%	13,564	16.7%	13,564	16.7%	13,564	16.7
		TLLMK	COUNTY SUBTOTAL				15,868	19.5%	15,868	19.5%	15,868	19.5%	15,868	19.5
0710	115	POLK	44	04	1	ESTUARY AND BAY	1,880	2.3%	1,880	2.3%	1,880	2.3%	1,880	2.3
1279	112	ALSEA	41	04	1	ESTUARY AND BAY	6,010	7.4%	5,757	7.1%	5,795	7.1%	5,795	7.1
		LNCLN	COUNTY SUBTOTAL				7,890	9.7%	7,637	9.4%	7,675	9.4%	7675	9.4
1082	109	ALSEA	40	05	1	ESTUARY AND BAY	170	0.2%	170	0.2%	170	0.2%	170	0.2
0799	110	SIUSLAW	40	05	1	ESTUARY AND BAY	8,745	10.8%	8,745	10.8%	8,745	10.8%	8,745	10.8
		LANE	COUNTY SUBTOTAL				8,915	11.0%	8,915	11.0%	8,915	11.0%	8,915	11.0
0319	104	ELKTON	30	06	2	ESTUARY AND BAY	17,754	21.9%	17,754	21.9%	17,754	21.9%	17,754	21.9
		DGLAS	COUNTY SUBTOTAL				17,754	21.9%	17,754	21.9%	17,754	21.9%	17,754	21.9
0192	118	ELKTON	26	07	2	ESTUARY AND BAY	5,270	6.5%	5,290	6.5%	5,300	6.5%	5,300	6.5
0218	118	SIXES	26	07	2	ESTUARY AND BAY	690	0.8%	690	0.8%	690	0.8%	690	0.8
0249	118	TIOGA	26	07	2	ESTUARY AND BAY	840	1.0%	840	1.0%	840	1.0%	840	1.0
		COOS	COUNTY SUBTOTAL				6,800	8.4%	6,820	8.4%	6,830	8.4%	6,830	8.4
0176	118	CHETCO	28	07	2	ESTUARY AND BAY	440	0.5%	440	0.5%	440	0.5%	440	0.5
		CURRY	COUNTY SUBTOTAL				440	0.5%	440	0.5%	440	0.5%	440	0.5
			T O T A L S				81,248	100.0%	81,015	99.7%	81,063	99.8%	81,063	99.8

APPENDIX 2
Wetland Habitat Inventory Summary
(Source: Oregon Wildlife Commission)

11 Coastal Salt Marsh (subtype of estuary and bay)

A. Description

Those lands found within a bay or estuary that contain vegetation consisting primarily of sedges. This area is generally just above the mean high tide line.

B. Location

Found in most coastal estuaries and bays.

C. Climate

Marine

D. Value to Wildlife

Valuable feeding area for waterfowl and snipe. Low value as nesting and brooding area because of possible flooding.

HABITAT INVENTORY SUMMARY

COASTAL SALT MARSH
OREGON COASTAL ZONE

18823 TOTAL ACRES THIS RETRIEVAL

LOCATION							1970		1980		1990		2000	
IN NUMBER	ONE DST	MGT UNIT	CO.	D	R	HABITAT TYPE	HABITAT TYPE ACRES	PER-CENT	HABITAT TYPE ACRES	PER-CENT	HABITAT TYPE ACRES	PER-CENT	HABITAT TYPE ACRES	PER-CENT
0916	113	CLATSOP	24	01	1	COASTAL SALT MRSH	8,660	46.0%	8,660	46.0%	8,660	46.0%	8,660	46.0
		CLTSP	COUNTY SUBTOTAL				8,660	46.0%	8,660	46.0%	8,660	46.0%	8,660	46.0
0885	113	CLATSOP	49	01	1	COASTAL SALT MRSH	1,600	8.5%	1,600	8.5%	1,600	8.5%	1,600	8.5
0864	113	NESTUCCA	49	01	1	COASTAL SALT MRSH	1,400	7.4%	1,400	7.4%	1,400	7.4%	1,400	7.4
		TLLMK	COUNTY SUBTOTAL				3,000	15.9%	3,000	15.9%	3,000	15.9%	3,000	15.9
0711	115	POLK	41	04	1	COASTAL SALT MRSH	659	3.5%	659	3.5%	659	3.5%	659	3.5
1277	112	ALSEA	41	04	1	COASTAL SALT MRSH	3,124	16.6%	2,983	15.8%	2,842	15.1%	2,700	14.3
		LNCLN	COUNTY SUBTOTAL				3,783	20.1%	3,642	19.3%	3,501	18.6%	3,359	17.8
1075	108	ALSEA	40	05	1	COASTAL SALT MRSH	156	0.8%	156	0.8%	156	0.8%	156	0.8
0800	110	SIUSLAW	40	05	1	COASTAL SALT MRSH	884	4.7%	684	3.6%	684	3.6%	684	3.6
		LANE	COUNTY SUBTOTAL				1,040	5.5%	840	4.4%	840	4.4%	840	4.4
0320	104	ELKTON	30	06	2	COASTAL SALT MRSH	1,220	6.5%	1,220	6.5%	1,220	6.5%	1,220	6.5
		DGLAS	COUNTY SUBTOTAL				1,220	6.5%	1,220	6.5%	1,220	6.5%	1,220	6.5
0193	118	ELKTON	26	07	2	COASTAL SALT MRSH	960	5.1%	960	5.1%	960	5.1%	960	5.1
0219	118	SIXES	26	07	2	COASTAL SALT MRSH	160	0.9%	160	0.9%	160	0.9%	160	0.9
		COOS	COUNTY SUBTOTAL				1,120	6.0%	1,120	6.0%	1,120	6.0%	1,120	6.0
			TOTALS				18,823	100.0%	18,482	98.2%	18,341	97.4%	18,199	96.7

12 Coastal Tideland (subtype of estuary and bay)

A. Description

Those lands found in a bay or estuary that are exposed at low mean tide. These areas are devoid of vegetation. Commonly called mud flats.

B. Location

Found in most coastal estuaries. Most abundant in Coos and Tillamook bays.

C. Climate

Marine

D. Value to Wildlife

Extremely valuable feeding area for shore birds, water birds and waterfowl. Haul-out grounds for seals.

STORET RETRIEVAL
OREGON STATE GAME COMMISSION

HABITAT INVENTORY SUMMARY

COASTAL TIDELANDS
OREGON COASTAL ZONE

25196 TOTAL ACRES THIS RETRIEVAL

STN NMBR	GME DST	MGT UNIT	LOCATION CO.	A D	R	HABITAT TYPE	1970 HABITAT TYPE ACRES	1970 PER-CENT	1980 HABITAT TYPE ACRES	1980 PER-CENT	1990 HABITAT TYPE ACRES	1990 PER-CENT	2000 HABITAT TYPE ACRES	2000 PER-CENT
0913	113	CLATSOP	24 01	1	COASTAL TIDELAND	6,286	24.9%	6,286	24.9%	6,286	24.9%	6,286	24.9
			CLTSP		COUNTY SUBTOTAL	6,286	24.9%	6,286	24.9%	6,286	24.9%	6,286	24.9
0883	113	CLATSOP	49 01	1	COASTAL TIDELAND	586	2.3%	586	2.3%	586	2.3%	586	2.3
0865	113	NESTUCCA	49 01	1	COASTAL TIDELAND	6,205	24.6%	6,205	24.6%	6,205	24.6%	6,205	24.6
			TLLMK		COUNTY SUBTOTAL	6,791	26.9%	6,791	26.9%	6,791	26.9%	6,791	26.9
0712	115	POLK	41 04	1	COASTAL TIDELAND	546	2.2%	546	2.2%	546	2.2%	546	2.2
1278	112	ALSEA	41 04	1	COASTAL TIDELAND	2,740	10.9%	2,257	9.0%	1,795	7.1%	1,795	7.1
			LNCLN		COUNTY SUBTOTAL	3,286	13.1%	2,803	11.2%	2,341	9.3%	2,341	9.3
1069	109	ALSEA	40 05	1	COASTAL TIDELAND	81	0.3%	81	0.3%	81	0.3%	81	0.
0797	110	SIUSLAW	40 05	1	COASTAL TIDELAND	592	2.3%	547	2.2%	547	2.2%	547	2.
			LANE		COUNTY SUBTOTAL	673	2.6%	628	2.5%	628	2.5%	628	2.5
0321	104	ELKTON	30 06	2	COASTAL TIDELAND	3,340	13.3%	3,340	13.3%	3,340	13.3%	3,340	13.
			DGLAS		COUNTY SUBTOTAL	3,340	13.3%	3,340	13.3%	3,340	13.3%	3,340	13.3
0194	118	ELKTON	26 07	2	COASTAL TIDELAND	3,420	13.6%	3,410	13.5%	3,410	13.5%	3,430	13.
0220	118	SIXES	26 07	2	COASTAL TIDELAND	820	3.3%	845	3.4%	870	3.5%	870	3.
0250	118	TIOGA	26 07	2	COASTAL TIDELAND	480	1.9%	440	1.7%	440	1.7%	440	1.7
			COOS		COUNTY SUBTOTAL	4,720	18.7%	4,695	18.6%	4,720	18.7%	4,740	18.
0177	118	CHETCO	28 07	2	COASTAL TIDELAND	100	0.4%	100	0.4%	100	0.4%	100	0.
			CURRY		COUNTY SUBTOTAL	100	0.4%	100	0.4%	100	0.4%	100	0.
			TOTALS			25,196	100.0%	24,443	97.0%	24,206	96.1	24,226	96.

13 Eelgrass (subtype of estuary and bay)

A. Description

This type occurs within the estuary and bay types. Composed of beds of eel grass (Zostera sp.).

B. Location

Coastal bays.

C. Climate

Marine

D. Value to Wildlife

An important feeding area for brant and other waterfowl.

STORET RETRIEVAL
OREGON STATE GAME COMMISSION

DATE 04/24/73

HABITAT INVENTORY SUMMARY

EELGRASS BEDS
OREGON COASTAL ZONE

000005019 TOTAL ACRES THIS RETRIEVAL

LOCATION STN NMBR	GME DST	MGT UNIT	CO.	D	R	HABITAT TYPE	1970 HABITAT TYPE ACRES	1970 PER-CENT	1980 HABITAT TYPE ACRES	1980 PER-CENT	1990 HABITAT TYPE ACRES	1990 PER-CENT	2000 HABITAT TYPE ACRES	2000 PER-CENT
0914	113	CLATSOP	24	01	1	EELGRASS	80	1.6%	100	2.0%	110	2.2%	120	2.4
		CLTSP	COUNTY SUBTOTAL				80	1.6%	100	2.0%	110	2.2%	120	2.4
0884	113	CLATSOP	49	01	1	EELGRASS	1,200	23.9%	1,250	24.9%	1,275	25.4%	1,300	25.9
0866	113	NESTUCCA	49	01	1	EELGRASS	1,200	23.9%	1,300	25.9%	1,400	27.9%	1,500	29.9
		YLEMK	COUNTY SUBTOTAL				2,400	47.8%	2,550	50.8%	2,675	53.3%	2,800	55.8
0713	115	POLK	41	04	1	EELGRASS	25	0.5%	25	0.5%	25	0.5%	25	0.5
1273	112	ALSEA	41	04	1	EELGRASS	411	8.2%	391	7.8%	371	7.4%	351	7.0
		LNCLN	COUNTY SUBTOTAL				436	8.7%	416	8.3%	396	7.9%	376	7.5
1070	109	ALSEA	40	05	1	EELGRASS	38	0.8%	38	0.8%	38	0.8%	38	0.8
0798	110	SIUSLAW	40	05	1	EELGRASS	285	5.7%	252	5.0%	252	5.0%	252	5.0
		LANE	COUNTY SUBTOTAL				323	6.4%	290	5.8%	290	5.8%	290	5.8
0322	104	ELKTON	30	06	2	EELGRASS	100	2.0%	100	2.0%	100	2.0%	100	2.0
		DGLAS	COUNTY SUBTOTAL				100	2.0%	100	2.0%	100	2.0%	100	2.0
0195	118	ELKTON	26	07	2	EELGRASS	1,430	28.5%	1,400	27.9%	1,380	27.5%	1,360	27.1
0221	118	SIXES	26	07	2	EELGRASS	250	5.0%	225	4.5%	200	4.0%	200	4.0
		COOS	COUNTY SUBTOTAL				1,680	33.5%	1,625	32.4%	1,580	31.5%	1,560	31.1
			TOTALS				5,019	100.0%	5,081	101.2%	5,151	102.6%	5,246	104.5

21 Inland Marsh

A. Description

This type is defined as a shallow water area, not including coastal bay marsh, with water remaining year-around. Usually the marsh is shallow enough to be vegetated throughout or has patches of open water. Tules and cattails are common indicator plants of this type.

B. Location

Scattered throughout the state but most areas are in central and southeastern Oregon. Examples are: Summer Lake, Malhuer, and Fern Ridge Reservoir.

C. Climate

Variable

D. Value to Wildlife

Contains some of our most important waterfowl and water bird nesting and wintering areas. This is a critical environment because of the limited acreage of this type in Oregon.

STORET RETRIEVAL
OREGON STATE GAME COMMISSION

DATE 04/24/73

HABITAT INVENTORY SUMMARY

INLAND MARSH
OREGON COASTAL ZONE

000006348 TOTAL ACRES THIS RETRIEVAL

******** LOCATION *********						**********	1970		1980		1990		2000	
STN NMBR	GME DST	MGT UNIT	CO.	A D	R	HABITAT TYPE	HABITAT TYPE ACRES	PER-CENT	HABITAT TYPE ACRES	PER-CENT	HABITAT TYPE ACRES	PER-CENT	HABITAT TYPE ACRES	PER-CENT
0918	113	CLATSOP	24	01	1	INLAND MARSH	4,608	72.6%	4,608	72.6%	4,608	72.6%	4,608	72.6
			CLTSP			COUNTY SUBTOTAL	4,608	72.6%	4,608	72.6%	4,608	72.6%	4,608	72.6
1077	109	ALSEA	40	05	1	INLAND MARSH	340	5.4%	340	5.4%	340	5.4%	340	5.4
0801	110	SIUSLAW	40	05	1	INLAND MARSH	320	5.0%	320	5.0%	300	4.7%	280	4.4
			LANE			COUNTY SUBTOTAL	660	10.4%	660	10.4%	640	10.1%	620	9.8
0196	118	ELKTON	26	07	2	INLAND MARSH	1,080	17.0%	1,080	17.0%	1,080	17.0%	1,080	17.0
			COOS			COUNTY SUBTOTAL	1,080	17.0%	1,080	17.0%	1,080	17.0%	1,080	17.0
						TOTALS	6,348	100.0%	6,348	100.0%	6,328	99.7%	6,308	99.4

24 Lakes and Reservoirs

A. Description

All open fresh-water areas, including alkaline waters. Borders are sometimes vegetated with water-tolerant forbs, shrubs, and trees.

B. Location

Statewide

C. Climate

Variable

D. Value to Wildlife

The value of these areas varies with type and location. Most offer resting and limited feeding to waterfowl. Many of the large reservoirs are of low value because of continuous water level fluctuation.

HABITAT INVENTORY SUMMARY

LAKES AND RESERVOIRS
OREGON COASTAL ZONE

000011930 TOTAL ACRES THIS RETRIEVAL

******** LOCATION ********								1970		1980		1990		2000	
STN NMBR	GME DST	MGT UNIT	CO.	A D	R	HABITAT TYPE		HABITAT TYPE ACRES	PER-CENT	HABITAT TYPE ACRES	PER-CENT	HABITAT TYPE ACRES	PER-CENT	HABITAT TYPE ACRES	PER-CENT
0919	113	CLATSOP	24	01	1	LAKES & RESRVOIRS		576	4.8%	661	5.5%	726	6.1%	786	6.6
0894	113	WILSON	24	01	1	LAKES & RESRVOIRS		24	0.2%	24	0.2%	24	0.2%	24	0.2
			CLTSP	COUNTY		SUBTOTAL		600	5.0%	685	5.7%	750	6.3%	810	6.8
0888	133	CLATSOP	49	01	1	LAKES & RESRVOIRS		6	0.1%	9	0.1%	9	0.1%	9	0.1
0906	113	WILSON	49	01	1	LAKES & RESRVOIRS		10	0.1%	10	0.1%	10	0.1%	10	0.1
0868	113	NESTUCCA	49	01	1	LAKES & RESRVOIRS		192	1.6%	192	1.6%	192	1.6%	192	1.6
			TLLMK	COUNTY		SUBTOTAL		208	1.7%	211	1.8%	211	1.8%	211	1.8
0714	115	POLK	41	04	1	LAKES & RESRVOIRS		630	5.3%	630	5.3%	630	5.3%	630	5.3
1280	112	ALSEA	41	04	1	LAKES & RESRVOIRS		320	2.7%	1,878	15.7%	3,416	28.6%	4,934	41.4
			LNCLN	COUNTY		SUBTOTAL		950	8.0%	2,508	21.0%	4,046	33.9%	5,564	46.6
1072	109	ALSEA	40	05	1	LAKES & RESRVOIRS		719	6.0%	831	7.0%	943	7.9%	1,055	8.8
0802	110	SIUSLAW	40	05	1	LAKES & RESRVOIRS		3,772	31.6%	4,785	40.1%	5,209	43.7%	5,209	43.7
			LANE	COUNTY		SUBTOTAL		4,491	37.6%	5,616	47.1%	6,152	51.6%	6,264	52.5
0324	104	ELKTON	30	06	2	LAKES & RESRVOIRS		2,731	22.9%	2,851	23.9%	3,063	25.7%	5,303	44.5
			DGLAS	COUNTY		SUBTOTAL		2,731	22.9%	2,851	23.9%	3,063	25.7%	5,303	44.5
0197	118	ELKTON	26	07	2	LAKES & RESRVOIRS		1,780	14.9%	1,780	14.9%	1,780	14.9%	1,780	14.9
0224	118	SIXES	26	07	2	LAKES & RESRVOIRS		840	7.0%	840	7.0%	840	7.0%	840	7.0
			COOS	COUNTY		SUBTOTAL		2,620	22.0%	2,620	22.0%	2,620	22.0%	2,620	22.0
0237	118	SIXES	28	07	2	LAKES & RESRVOIRS		300	2.5%	300	2.5%	300	2.5%	300	2.5
0180	118	CHETCO	28	07	2	LAKES & RESRVOIRS		30	0.3%	30	0.3%	30	0.3%	30	0.3
			CURRY	COUNTY		SUBTOTAL		330	2.8%	330	2.8%	330	2.8%	330	2.8
				T O T A L S				11,930	100.0%	14,821	124.2%	17,172	143.9%	21,102	176.9

33 Wet Meadows

A. Description

Small damp areas, generally with many small springs or bisected by slow-moving streams. Contain sedges, monkey flower, skunk cabbage, false helabore, aspen, cone flower, or similar species.

B. Location

Statewide in wetter climates. May be found at lower elevation in the coastal and westerrr Oregon areas and at higher elevation in eastern Oregon.

C. Climate

Variable, but generally mild.

D. Value to Wildlife

A very important vegetation type. Provides late summer and fall forage to big game. Utilized as wallows by bear and elk. Are usually important watering areas.

STORET RETRIEVAL
OREGON STATE GAME COMMISSION

DATE 04/24/73

HABITAT INVENTORY SUMMARY

WET MEADOWS
OREGON COASTAL ZONE

000005810 TOTAL ACRES THIS RETRIEVAL

******** LOCATION *********						**********	1970		1980		1990		2000	
STN NMBR	GME DST	MGT UNIT	CO.	D	R	HABITAT TYPE	HABITAT TYPE ACRES	PER-CENT	HABITAT TYPE ACRES	PER-CENT	HABITAT TYPE ACRES	PER-CENT	HABITAT TYPE ACRES	PER-CENT
0715	115	POLK	41	04	1	WET MEADOWS	370	6.4%	370	6.4%	370	6.4%	370	6.4
		LNCLN	COUNTY SUBTOTAL				370	6.4%	370	6.4%	370	6.4%	370	6.4
0325	104	ELKTON	30	06	2	WET MEADOWS	1,140	19.6%	876	15.1%	616	10.6%	220	3.8
		DGLAS	COUNTY SUBTOTAL				1,140	19.6%	876	15.1%	616	10.6%	220	3.8
0198	118	ELKTON	26	07	2	WET MEADOWS	420	7.2%	400	6.9%	380	6.5%	380	6.5
0225	118	SIXES	26	07	2	WET MEADOWS	40	0.7%	40	0.7%	40	0.7%	40	0.7
0251	118	TIOGA	26	07	2	WET MEADOWS	100	3.1%	170	2.9%	170	2.9%	170	2.9
0206	118	POWERS	26	07	2	WET MEADOWS	3,200	55.1%	3,200	55.1%	3,200	55.1%	3,200	55.1
		COOS	COUNTY SUBTOTAL				3,840	66.1%	3,810	65.6%	3,790	65.2%	3,790	65.2
0238	118	SIXES	28	07	2	WET MEADOWS	180	3.1%	180	3.1%	180	3.1%	180	3.1
0181	118	CHETCO	28	07	2	WET MEADOWS	280	4.8%	280	4.8%	280	4.8%	280	4.8
		CURRY	COUNTY SUBTOTAL				460	7.9%	460	7.9%	460	7.9%	460	7.9
			TOTALS				5,810	100.0%	5,516	94.9%	5,236	90.1%	4,840	83.3

37 Riparian Vegetation

A. Description

This type occurs along streams, rivers, and slough banks. Vegetation is usually in a dense narrow band. Species of plants identifying this type are those dependent on the water such as willow, cottonwood, alder, and aspen. Only valley and foothill riparian cover would be included in this type. Mountain or timber type areas would be included in the timber type.

B. Location

Statewide in valley and foothill areas.

C. Climate

Variable

D. Value to Wildlife

An important wildlife habitat type. The riparian vegetation is a concentration point for a great variety of game and non-game species, providing food and cover. This vegetation renders the more open grassland and agricultural areas suitable as wildlife feeding areas by providing the necessary cover.

STORET RETRIEVAL
OREGON STATE GAME COMMISSION

DATE 04/24/73

HABITAT INVENTORY SUMMARY

RIPARIAN VEGETATION
OREGON COASTAL ZONE

000025815 TOTAL ACRES THIS RETRIEVAL

******** LOCATION *********						********	1970		1980		1990		2000	
STN NMBR	GME DST	MGT UNIT	A CO.	O	R	HABITAT TYPE	HABITAT TYPE ACRES	PER-CENT	HABITAT TYPE ACRES	PER-CENT	HABITAT TYPE ACRES	PER-CENT	HABITAT TYPE ACRES	PER-CENT
0920	113	CLATSOP	24	01	1	RIPARIAN VEGETATN	3,150	12.2%	3,150	12.2%	3,150	12.2%	3,150	12.2
			CLTSP			COUNTY SUBTOTAL	3,150	12.2%	3,150	12.2%	3,150	12.2%	3,150	12.2
0716	115	POLK	44	04	1	RIPARIAN VEGETATN	30	0.1%	30	0.1%	30	0.1%	30	0.1
			~~POLK~~ LNCLN			COUNTY SUBTOTAL	30	0.1%	30	0.1%	30	0.1%	30	0.1
1081	109	ALSEA	40	05	1	RIPARIAN VEGETATN	3,850	14.9%	3,700	14.3%	3,550	13.8%	3,350	13.0
0803	110	SIUSLAW	40	05	1	RIPARIAN VEGETATN	6,480	25.1%	6,480	25.1%	6,480	25.1%	6,480	25.1
			LANE			COUNTY SUBTOTAL	10,330	40.0%	10,180	39.4%	10,030	38.9%	9,830	38.1
0326	104	ELKTON	30	06	2	RIPARIAN VEGETATN	8,547	33.1%	6,897	26.7%	3,139	12.2%	1,495	5.8
			DGLAS			COUNTY SUBTOTAL	8,547	33.1%	6,897	26.7%	3,139	12.2%	1,495	5.8
0199	118	ELKTON	26	07	2	RIPARIAN VEGETATN	80	0.3%	80	0.3%	80	0.3%	80	0.3
0226	118	SIXES	26	07	2	RIPARIAN VEGETATN	40	0.2%	40	0.2%	40	0.2%	40	0.2
0252	118	TIOGA	26	07	2	RIPARIAN VEGETATN	1,018	3.9%	1,018	3.9%	1,018	3.9%	1,018	3.9
0207	118	POWERS	26	07	2	RIPARIAN VEGETATN	1,000	3.9%	1,000	3.9%	1,000	3.9%	1,000	3.9
			COOS			COUNTY SUBTOTAL	2,138	8.3%	2,138	8.3%	2,138	8.3%	2,138	8.3
0239	118	SIXES	28	07	2	RIPARIAN VEGETATN	420	1.6%	420	1.6%	420	1.6%	420	1.6
0182	118	CHETCO	28	07	2	RIPARIAN VEGETATN	1,200	4.6%	1,200	4.6%	1,200	4.6%	1,200	4.6
			CURRY			COUNTY SUBTOTAL	1,620	6.3%	1,620	6.3%	1,620	6.3%	1,620	6.3
						TOTALS	25,815	100.0%	24,015	93.0%	20,107	77.9%	18,263	70.7

Coding System for Oregon Game Management Units

Name	Abrv.	No.	Name	Abrv.	No.	Name	Abrv.	No.
Alsea	ALS	131	Keno	KEN	154	Silvies	SIV	17
Applegate	APP	132	Klamath	KLA	155	Siuslaw	SIW	17
Baker	BAK	133	Lookout Mt.	LOM	156	Sixes	SIX	17
Beulah	BEU	134	Malheur River	MAL	157	Sled Springs	SLS	18
Catherine Cr.	CAC	135	Maupin	MAP	158	Snake River	SNR	18
Chesnimnus	CHS	136	Maury	MAU	159	Sprague	SPR	18
Chetco	CHT	137	McKenzie	MCK	160	Starkey	STA	18
Clatsop	CLT	138	Melrose	MEL	161	Steens Mt.	STM	18
Columbia Basin	COB	139	Metolius	MET	162	Tioga	TIO	185
Deschutes	DCH	140	Minam	MIN	163	Trask	TRA	18
Desblation	DES	141	Murderer's Cr.	MUC	164	Ukiah	UKI	18
Dixon	DIX	142	Nestucca	NES	165	Umatilla	UMA	188
Elkton	ELK	143	Northside	NOR	166	Wagontire	WAG	18
Evans Creek	EVC	144	Ochoco	OCH	167	Walla Walla	WAL	190
Fort Rock	FOR	145	Owyhee	OWY	168	Warner	WAR	19
Grizzly	GRI	146	Paulina	PAU	169	Wasco	WAS	19
Hart Mountain	HAM	147	Polk	POL	170	Wenaha	WEN	193
Heppner	HEP	148	Powers	POW	171	Wheeler	WHE	19
Hood River	HOR	149	Rogue	ROG	172	Whitehorse	WHI	19
Immaha	IMN	150	Santiam	SAN	173	Willamette	WIL	196
Interstate	INT	151	Scappoose	SCA	174	Wilson	WLS	19
Juniper	JUN	152	Sherman	SHE	175			
ting	KEA	153	Silver Lake	SIL	176			

Revised 3/73

APPENDIX 3

Marsh-Estuary Interactions

(Source: Coastal Wetlands of Virginia, Interim Report)

The diagram illustrating the interactions between physical and biotic interactions (Fig. 1) is drawn with the factors most involved on the left-hand side. The following commentary will begin with major interactors and proceed clockwise around the diagram.

1. Marsh Plants. Affected by:

   a) Tidal range causes a greater luxuriance where daily inundation occurs.

   b) Water chemistry determines the species of plants present and their productivity to a great extent.

   c) Turbid water during a high tide coats photosynthesizing surfaces and affects production of organic compounds.

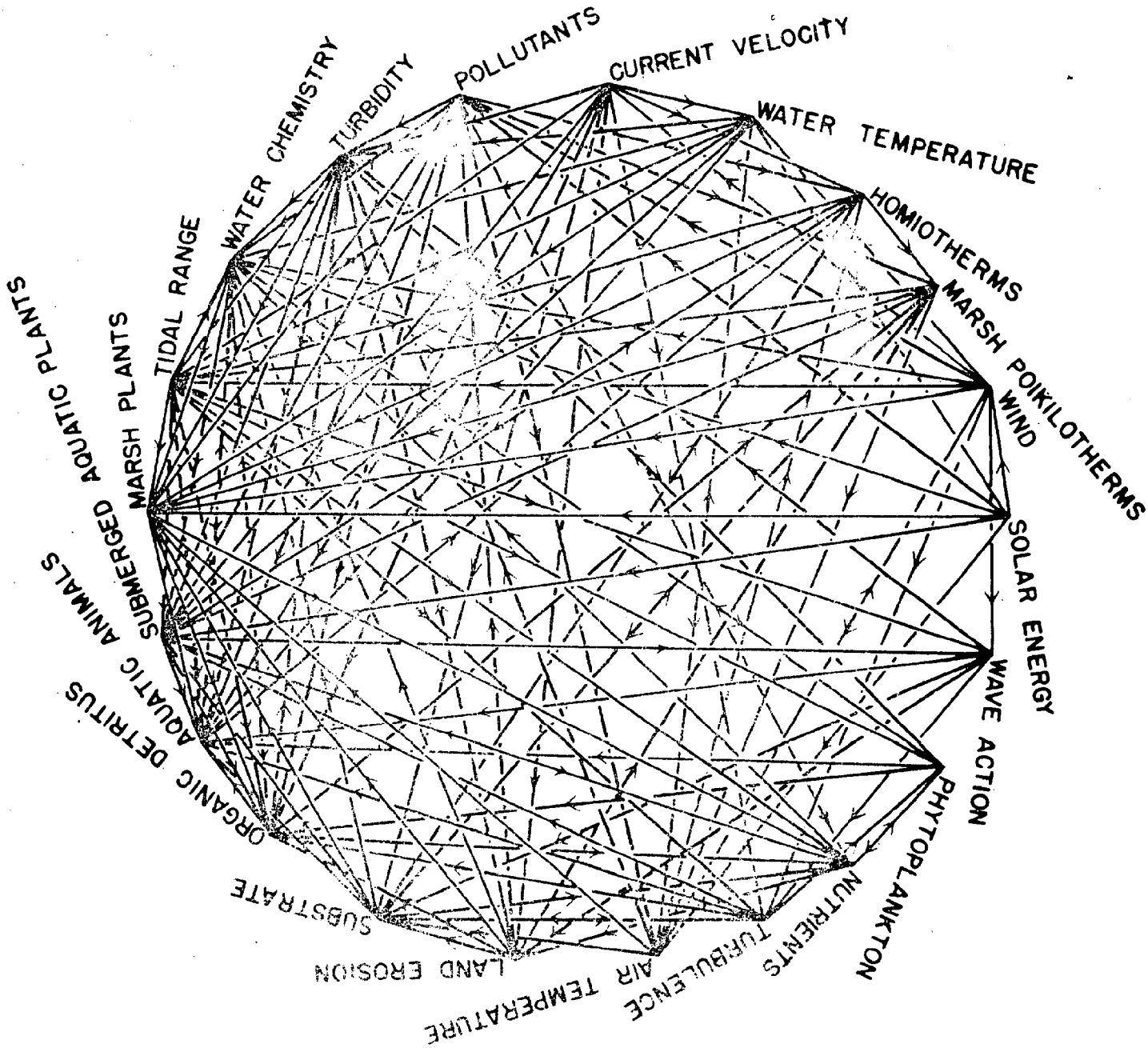
   d) Pollutants--Organic pollution often enhances plant growth; thermal pollution increases growth in some plants, decreases it in others.

   e) Water temperature, especially where tides cover the soil, affects growth and seed germination.

   f) Homiotherms affect marsh plants in several ways--Building of nests by birds has little effect, grubbing for roots by Muskrats and Snow Geese has long-lasting results; grazing by Nutria may deprive aquatic animals of food but increases phytoplankton production since feces would be swept into the water; Blackbirds and waterfowl may eat most of the seed produced by some marsh plants but ducks are known to carry seeds to new areas; Marsh Wrens and Yellow-throats eat grasshoppers and other insects which feed on marsh plants; finally, man benefits physically and aesthetically from marsh plants in many ways and has eminent domain over their survival.

   g) Marsh poikilotherms are here intended to include Fiddlers, Crayfish, insects, frogs, snakes, turtles and those fish which live in close proximity to the marsh. Square-backed Fiddlers eat considerable quantities of Spartina grass, grasshoppers may eat 5% of the total grass production and leaf hoppers suck the juices of plants, Carp erode away the soil from plant roots.

   h) Wind is needed to pollinate plants but strong winds may cause some plants to lodge.



MARSH-ESTUARY INTERACTIONS

Diagrammatic flow of biotic and physical effects, both unidirectional and reciprocal, in a marsh-bordered estuary.

i) Without solar energy, green plants could not grow.

j) Plants also require nutrients and may grow better next to channels because certain minerals are more available there; plants also release stored nutrients as microbes degrade dead tissue.

k) Some perennial marsh plants grow a little during the winter but warm air temperatures are needed for fast growth.

l) Land erosion affects plants by depositing more silt in marshes--usually this accumulates more in creeks and results in destruction of productive marsh; type of soil substrate, if clay or sand, seems minor in affecting type of plant growth, but a tough peat base is much more erosion resistant.

m) Plants provide abundant detritus to the estuary if tidal range or floods are effective.

n) Smaller aquatic animals feed on detritus supplied by plants.

2. Tidal range is highly important to an estuary. Its greater height in the brackish to fresh zones and on seaside makes those areas more productive. Higher tides have many effects:

a) They provide for greater exchange of nutrients and waste products.

b) Turbidity is increased.

c) Current velocity is heightened on the ebb tide and dampened (in rivers) on the flood.

d) Water temperatures are moderated over the wetlands by being cooled in summer and warmed in winter.

e) Homiotherms are able to feed in marshes and flats when the tide is out, except for ducks which usually find food more available at high tide. Birds and mammals which breed in the marsh must elevate their nest structures above the highest tide levels.

f) Likewise, Fiddler Crabs must enter their burrows and snails must climb up the grasses to escape predation by fish as the tide comes in. On the Eastern Shore, some species of fish lays its eggs in the shell cavity of a dead Ribbed Mussel at high tide, and live Mussels and marsh Oysters can feed only when the tide is in. Insects may stay above the tide, but the Greenhead Fly and Salt-marsh Mosquito (Aedes solicitans) evidently deposit their

eggs when the tide is out. The Striped Killifish "adheres to the very shore's edge" (22) on a flood tide and other small fish probably do the same, ranging into the marsh on the highest tides.

g) High winds greatly amplify tides, piling water into the Bay with sustained northeast wind and blowing it out with prolonged northwest winds in winter. In the latter situation, gulls have an opportunity to carry off shellfish on very low tides. Killifish burrow in the mud to escape death, but some invertebrates may die when frozen during low tide.

h) Wave action obviously affects more area during high tides.

i) Phytoplankton composition would be quite different in marsh pools and guts if tides did not provide an exchange of water. Since plankton productivity is higher in marsh pools than in the river, tides carry this living material to the estuary.

j) Nutrient exchange requires tidal transport.

k) Turbulence is more dependent on wind than on tides, but tides alone have an effect.

l) Organic detritus would not be supplied to the water in significant amounts without good tidal exchange.

m) Aquatic animals benefit from wetlands through the agency of tides.

n) Submerged plants may benefit from nutrients released from marshes but they also are prevented from growing on mudflats bared at low tide.

3. Water Chemistry. Oxygen, salinity, phosphorus, nitrogen and, in freshwater, alkalinity are particularly involved. Water chemistry is affected by many factors and, in turn, affects many others.

a) Turbid waters become clearer in the estuary due to the flocculating effect of saline water.

b) Pollutants affect water by their biological oxygen demand (BOD). Marshes help aerate the water during high tide and they release the least organic matter in summer when oxygen is naturally low. Pollution, either organic, toxic, or thermal, exerts the greatest influence in the summer. Saline water coagulates fine particles and causes them to sediment out, resulting in a diminution of organic pollution to safer levels.

c) Water temperature strongly affects chemical reactions, which tend to double with each 10°C rise.

d) Wind affects water chemistry mainly by oxygenating the water but also by producing high tides which flush detritus and nutrients from the marsh.

e) Solar energy causes photo-oxidation of some chemicals and otherwise affects chemistry by providing energy for storms.

f) Phytoplankton requires nutrients and also produces oxygen by day and uses it by night.

g) Nutrients produced elsewhere become part of the total water chemistry.

h) Land erosion brings clay, organic material and toxic wastes which affect normal water chemistry.

i) Substrates have a lesser effect on the overall chemistry, but the myriad stems of marsh plants are instrumental in accumulating clay particles at least temporarily.

j) Water chemistry and organic detritus interact--saline water precipitating fine organics while organics supply nutrients.

k) Aquatic animals require ample oxygen, especially the more active organisms, but they produce carbon dioxide which affects pH and reduces the rate of oxidation of organic debris.

l) Submerged aquatic plants release large amounts of oxygen, some of which they need for respiration at night. Nutrients and salt concentrations which cause one plant species to luxuriate may be deleterious to another.

4. Turbidity, the condition of having varying amounts of suspended materials in water, is particularly evident in tidal freshwater.

a) Pollutants increase turbidity.

b) Strong currents increase turbidity, as evidenced by the Hurricane Camille floods.

c) Water temperature is affected by turbidity--dark water absorbs more heat.

d) Wave action also increases turbidity.

e) Turbidity affects phytoplankton by decreasing the compensation point depth but phytoplankton by their abundance may affect turbidity.

f) Air temperature secondarily affects turbidity simply by heating the upper layers of water, thereby promoting stratification.

g) Land erosion is the source of most clay particles which produce turbidity.

h) Organic detritus increases turbidity, thus affecting phytoplankton production but at the same time nurturing a great amount of animal biomass.

i) Aquatic animals may be benefited or harmed by turbidity, depending on the nature and amount of the suspended materials.

j) Submerged aquatic plants are adversely affected by turbidity. Silt-laden rivers support little aquatic vegetation.

5. Pollutants have both direct and indirect effects which may often be complex and occur far from the source of pollution.

a) Warm-blooded animals are particularly affected by toxic pollutants such as chlorinated hydrocarbons. The Bald Eagle has become rare in Virginia in less than a decade because of DDT.

b) Cold-blooded animals of the marsh, such as Fiddler Crabs and Mosquitoes, are directly affected by pesticide pollutants.

c) Some pollutants--dust, aerial sprays and smoke--are carried by wind.

d) Sunlight is effective in decomposing many pollutants.

e) Warm air aids dispersal of dust and smoke.

f) Land erosion has historically affected the upper tidal reaches of rivers and creeks more than any other pollutant.

g) Organic detritus from sewage and manure often causes noxious pollution.

h) Aquatic animals, such as bivalve molluscs, may be adversely affected by silt and clay pollution. Pesticides particularly magnify in organisms as they enter a food chain via the detritus pathway and end up in tertiary carnivores such as the Osprey and humans.

i) Aquatic plants are adversely affected by excessive sewage wastes and severe siltation.

6. Current velocity varies with rain, tides, wind, and cross-section of a river.

a) It affects water temperature by making it more uniform.

b) Strong currents make feeding more difficult for ducks and grebes, as well as for swimming mammals.

c) Currents and turbulence are directly proportional to each other.

d) Land erosion products are carried distances proportional to the current velocity.

e) The same condition as in (d) applies to organic detritus.

f) Aquatic animals, especially smaller ones, are particularly affected by strong currents.

g) Submerged aquatic plants are seemingly less affected by currents.

7. Water temperatures may vary up to 60°F. The activities of the biota are much influenced by temperature.

a) Wind usually moderates water temperatures, but it also promotes mixing and thus general warming.

b) Temperature of the water ultimately depends on the sun's warmth.

c) Temperature of water and air together modify climates of wetlands.

d) Aquatic animals being cold-blooded have their activities dependent on water temperature; some cease feeding in winter.

e) Submerged aquatic plants typically regress in winter.

8. Homiotherms (warm-blooded animals) are less important to man than their aquatic relatives but scarcely less interesting.

a) Raccoons seem to feed in marshes mainly on Fiddler Crabs and Crayfish most of the year, although we did find one scat composed of only Macoma balthica shells. Wrens feed on insects and Rails on a variety of small animals.

b) While less affected by temperature than poikilotherms are, homiotherms must still adapt to the rigors of summer's heat and winter's chill.

c) Muskrats prefer marsh peat substrates for their houses and ramifying burrows. Otters like slick creek banks to

slide on. The Belted Kingfisher requires vertical clay banks for nest sites. Ground-nesting birds need dry sites, except for Rails, Coots, Gallinules and Willets which may use rather damp nest sites. These animals have adapted to marsh living but many others only come to marshes and swamps for food.

d) Many homiotherms, especially birds, feed on aquatic animals such as frogs and small fish.

e) Some ducks, such as the now scarce Canvasback and Redhead, eat rooted aquatic plants as most of their diet.

9. Marsh poikilotherms are mainly Fiddler Crabs, Killifishes, turtles, insects and a surprising number of spiders.

a) All of these creatures are able to retreat to shady or watery places when air temperatures become severe.

b) They are affected mildly by land erosion if silt fills their burrows, clouds the water and coats the vegetation.

c) Fiddlers feed on detritus somewhat and create more, as do most of the animals.

10. Wind is most effective in conjunction with high tides and its influence is particularly felt in seaside and bayside areas.

a) Solar energy is largely responsible for wind.

b) Wind, in turn, produces waves.

c) Wind, through waves, is largely responsible for turbulence in shallow waters.

d) Wind and air temperatures have a reciprocal relationship.

11. Solar energy may be blocked by cloud cover and its effect altered by the sun's angle to the earth, but it is otherwise independent of earthly phenomena.

a) Air temperature is most affected by the sun's heat.

b) Submerged aquatic plants depend as much on the sun, and thus also on clean water, as do the marsh plants.

12. Wave action depends highly on direction fetch and tide level, thus its effect on wetlands varies greatly.

a) Waves are directly responsible for most turbulence.

b) Bank erosion results in exposed areas if the land is unprotected by grass, gentle slope, or artifices.

c) Beach and marsh substrates are altered if waves carry away finer materials and deposit them in quieter waters.

d) Aquatic animals must be able to cope with strong waves or retreat from them.

e) Aquatic plants, such as Eelgrass, are torn loose and deposited on beaches by waves.

13. Phytoplankton consists of one-celled plants, particularly diatoms and dinoflagellates.

a) Phytoplankton change inorganic nutrients into organic compounds capable of being digested by certain crustaceans and fishes.

b) Turbulence may supply nutrients to phytoplankters but may also make the water turbid and thus reduce the light supply.

c) Organic detritus is partially produced by phytoplankton, especially in summer.

d) Many aquatic animals feed directly on plankton.

14. Nutrients include inorganic and organic compounds.

a) Erosion of the land produces certain nutrients but may also tie up others on clay particles.

b) As with phytoplankton, rooted aquatics utilize simple compounds to produce complex food substances.

15. Turbulence refers particularly to the vertical mixing of water.

a) Substrates may be eroded by turbulent water.

b) Organic detritus is kept in suspension by turbulence.

c) Aquatic animals, particularly filter feeders, require some turbulence.

d) Submerged rooted plants probably thrive better where turbulence is only moderate.

16. Air temperature varies daily and seasonally and affects the activities of all organisms in shallow water, flats and marshes.

17. Land erosion produces only minor amounts of beneficial organic detritus. Erosion of high ground is largely detrimental.

18. Substrate type often determines the kinds of benthic animals present.

19. Organic detritus is essential to many aquatic animals. Submerged aquatic plants may contribute considerable detritus in some water.

20. Relatively few aquatic animals feed directly on rooted aquatic plants.